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Contracting Practice.

By DeWitt V. Moore, Mem. Am. Soc. Eng. Contr., Indianapolis, Ind.

BOOKKEEPING SYSTEM.

IN the November number we proceeded as far in the construction as to cover Time Distribution sheets, Identification Cards, Pay Roll Voucher Checks, Pay Roll Envelopes and the Pay Roll which remains on file in the office.

The methods outlined in that number covered the field end of the construction department and its connection with the office.

The independent work of the office contemplates the completion of these records by the bookkeeping system described in this issue.

In the first place we must have the ordinary double ledger, the same as is used by any ordinary mercantile business. In this ledger are carried the personal accounts of all individuals with whom the concern may be dealing. The larger accounts are carried under the firm name. Individual and miscellaneous accounts are carried under "Miscellaneous Accounts Payable or Receivable," and in making the ledger entries a vacant line is left opposite the respective debit and credit entry, so that when the account is settled an entry will show on both sides of the page. In other words, a vacant line on either side of the page is an indication that the account has not been closed. This naturally means that such accounts are carried as individual accounts under a miscellaneous classification, but are not necessarily in chronological order. For instance, if John Smith is credited with an invoice of $1,000.00 under date of September 15th, several other accounts may follow, but when this account is paid under date of November 20th, the entry is made exactly opposite the September 15th credit thereby automatically indicating that this particular transaction is closed.

Other larger and more important accounts where the invoices accumulate should be given an individual page.

Passing this subject of the ledger bookkeeping which is a more or less purely commercial transaction, we pass to the particular bookkeeping which is applicable to Contracting Practice. We will refer first to Plate XVII which shows a form for all charges growing out of the operation of the contracting organization aand the gross amount of which must check with the ledger. This distribution sheet, headed "Material Distribution," serves as an index to all expenditures and all other expenditure records in the office. In other words, while serving as an index or voucher record it gives the distribution of expenditures in such a manner that we may know where and to what account expenditures have been made. In the extreme right hand column appears the total amount of expenditures item by item as payments are made, while the distribution of same may be confined to one column or divided among several. The heading of the distribution columns are adjusted to each contract according to the character of work and particular attention is called to the fact that the columns are arranged for credit and debit entries so that each account or each distribution is complete in final result.

In case there are more distributions than can be carried on one side of sheet, cut off the end of sheet and continue distributions on reverse side.

At the head of each column appears a numerical indicating the account number for the particular job the headings of the column being written in.

Supplementary to this general distribution sheet appears Plate XVIII which is the detail distribution of the pay roll which is in the same form as distribution shown on Time Sheet Plates X and XI. (November issue.)

Particular attention is called to the fact that the gross amount of Pay Roll

SHEET NO 1
CONTRACT NO 21
CONTRACTING PARTY
ADDRESS

PAY ROLL DISTRIBUTION

PLATE XVIII

LOCATION OF WORK — CHARACTER OF WORK

PAY ROLL			A			B			C			D			E			F			G			H			I			J			K			CEMENT USED				
VOUCHER NO	PERIOD BEGINNING	PERIOD ENDING	Excavation			Filling			Concrete			Forms			Finish			Brick			Stone															NO OF BAGS	WHERE USED	NO OF BAGS	WHERE USED	NO OF BAGS	WHERE USED	TOTAL
			PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST	PAY ROLL	QUANTITY	UNIT COST					

SHEET NO
CONTRACT NO
CONTRACTING PARTY
ADDRESS

MATERIAL DISTRIBUTION

PLATE XVII

LOCATION OF WORK — CHARACTER OF WORK

VOUCHER NO		DATE	1 Cement	2 Brick	3 Sand & Insur.	4 Expense	5 Lumber	6 Pay-Roll	7 Stone	8 Steel	9 Tools	TOTAL

PLATE XIX.

ACCOUNTS PAYABLE No._____

THE [redacted] COMPANY.

TO_____ DR.

_____ 190__

ORIGINAL

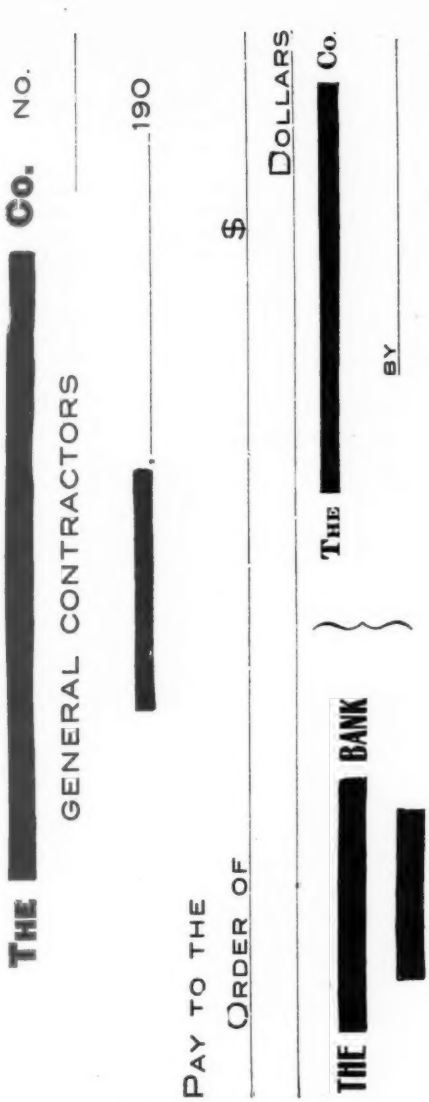
CONTRACT		DISTRIBUTION		DATE	ITEMS	AMOUNT	TOTAL.
No	ACT.		AMOUNT				

POSTED _____ B. K.

AUDITED AND REGISTERED _____

APPROVED FOR PAYMENT _____ SEC'Y _____ PRES.

appears on the material distribution sheet, Plate XVII, which properly may be designated as a general distribution. On this distribution sheet the Pay Roll account appears in column No. 6. On the detailed Pay Roll Distribution sheet appears this same account number with sub-letters heading each column agreeing with the letters heading column. Time sheet Plates X and XII. Under this system while no two jobs may have the same account numbers or letters for the same item, still if for any reason one particu-



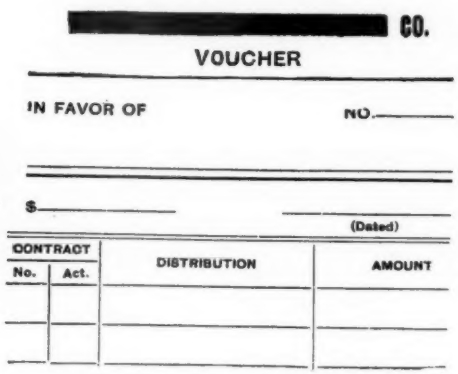
XX. CONTRACTING PRACTICE.
Reverse of Voucher.

lar job the nature of the account is indicated by the numeral and in case of Pay Roll this suffix of a letter indicates a particular classification and there can be no question or error in the proper bookkeeping or record of costs. The books shown in Plates XVII and XVIII are both loose leaf books.

The method of taking care of the Pay Roll has been fully outlined in the previous article of the November issue and we therefore proceed to the method of taking care of material bills and accounts payable.

It is preferable that accounts payable be handled under monthly vouchers. Two methods are suggested of which preference is given to the second. By the first method all invoices from any particular firm for the month are audited and recorded on the face of a voucher form, see Plate XIX. The reverse side of this voucher is in check form as shown by Plate XX. A duplicate of this voucher in same form is prepared at the same time as the original by means of carbon sheet. The reverse side, Plate XXI, showing distribution. To this duplicate are attached all the original invoices and thus duplicates and invoices are filed alphabetically, while the original voucher check is filed consecutively by number. By this method a record is kept both alphabetically and numerically. Both being filed folded, 3½ x8½, and filed in pigeon holes or boxes.

The second method, however, is recommended inasumch as it is sometimes impossible to clean up all accounts monthly. The difference lies in the fact that all invoices are attached to the original voucher. After being submitted and approved, payment is made by check, the voucher having space for voucher number and also check number. Inasmuch as pay-



XXI. CONTRACTING PRACTICE.
Duplicate of Voucher, Showing Distribution.

ment is made by check and the voucher remains in the alphabetical file, the same results are obtained as by the previous method, except, that we overcome the objection of the banks to handling folded checks and we have the opportunity for the payment of the voucher in repeated payments.

This form of handling accounts is shown by voucher form, Plate XXII. (Heavy paper.) The ordinary form of creck book is all that is necessary. A decided improvement over this system is shown by Plate XXIII, where the voucher is printed on the face of an envelope within which are contained all the invoices for any one particular firm for one

month. By this system not only do we obtain a distribution of the account but we have a record of each and every invoice. The opportunity is given for a definite record as to the time of payment, check number and receipt of any one invoice or of all invoices. At the same time reference is made to the ledger upon which page the particular account is carried. Should there be any question as to the account the contents of the envelope need not be disturbed.

Should there be any argument the face of the voucher envelope gives the record which may be verified by the contents of the envelope, and in case there is a question as to payment, an index is given to the different payments and check number which may be investigated to ascertain whether same was properly received and endorsed. This latter system is recommended as being a Combination Voucher and Filing System adaptable to any office large or small.

Should a creditor ask for an accounting and a checking up of account for any length of time all that is necessary to do is to refer to the alphabetical file containing his envelope month by month. An index is at once obtained to refer to the numerical file of cancelled checks. Under these conditions the ledger becomes simply a permanent book of record, inasmuch as the complete detail appears on the Voucher Envelope.

It will be noted that on the Pay Roll Distribution sheet the column is divided so that the cost of labor, and the record of amount of work performed are recorded, so that we may thereby arrive at the net unit of cost of the work. From this record in connection with the material distribution we are able to prepare statements at any time showing how the work is proceeding with reference to the original estimate. The information necessary as to the quantity of work performed is taken from the reverse side of the Time Sheet as shown by Plate XII, supplemented by office records and information not obtainable in the field.

In the payment of accounts the ordinary form of check book is used, upon the reverse side of the stub and check being stamped a form similar to Plate XIV. At the time a payment is made this form is filled out stating the job number and the account number, using the numerical index at the head of the column on the distribution sheets. If necessary, additional information may be shown by indicating under "Items,"

ACCOUNTS PAYABLE

NO._____
CHK._____

COMPANY

To_____ DR.

_____ 191__

CONTRACT		DISTRIBUTION		DATE	ITEMS	AMOUNT	TOTAL
No.	Act.	ITEMS	AMOUNT				

Received, inspected and found correct

_____ Chf. Engr.

Audited

_____ Chf. Clk.

Approved

_____

Received of the _____ CO.

_____ $_____

in full payment of account as stated above.

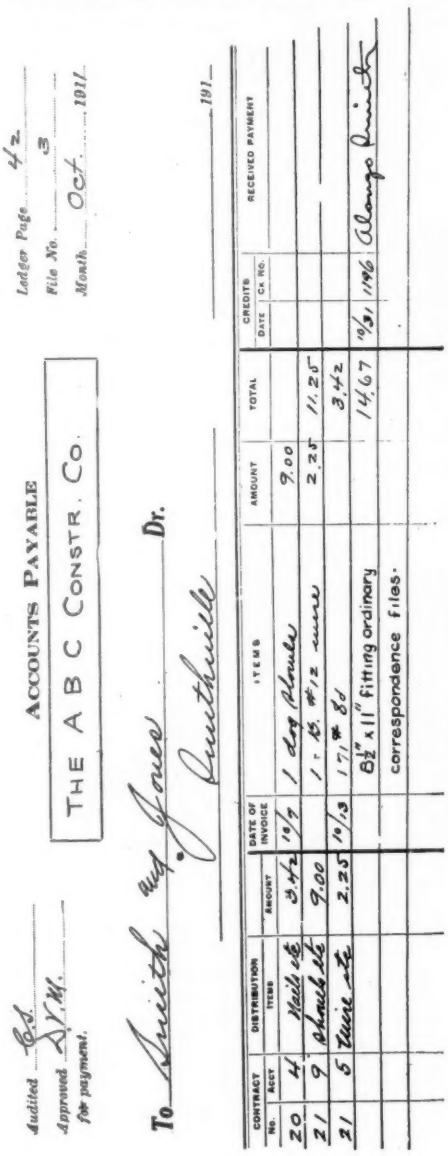
_____ 191

XXII. CONTRACTING PRACTICE. Voucher Form.

what the payment or check is for. Such a check becomes a voucher check which is explained by the voucher envelope on file in the office and the endorsement of such a check is not only a receipt for payment, but indicates at once the account for which payment is being made. Inasmuch as upon the reverse side of the stub appears the same distribution record the distribution sheets may be posted from the stub book.

This system is not in any sense complicated and may be developed for from ten to fifteen dollars for printing and rubber stamps, and inasmuch as it is adaptable to any job, large or small, and any number of jobs, it is deserving of consideration.

The voucher envelope bearing as it does a file number which is the job number, the files for each job may be kept separate. On the other hand, the system may be used alphabetically and all accounts filed accordingly. The latter method is probably prefereable inasmuch as the information is more readily obtainable and, when the distribution at the left hand side carries the job numbers, any one account may be carried together for the month, regardless of how


ACCOUNTS PAYABLE

THE A B C CONSTR. CO.

Ledger Page 42
File No. 3
Month Oct. 1911

Audited
Approved for payment.

To Quicktite Mfg. Co. Dr.
J. Smithville
191

CONTRACT No.	CONTRACT ACCT	DISTRIBUTION ITEMS	AMOUNT	DATE OF INVOICE	ITEMS	AMOUNT	TOTAL
20	4	Nails etc	3.42	10/2	1 keg Nails	9.00	
21	9	Sheeting etc	9.00		1 - 25 ft 12 inch	2.25	11.25
21	5	Tinning etc	2.25	10/3	17 ft 8d		3.42
					8½" x 11" Fitting ordinary correspondence files.		14.67

CREDITS: DATE, CK. NO. — RECEIVED PAYMENT: 10/31, 1146, Alamo Print Co.

XXIII. CONTRACTING PRACTICE.
Voucher Envelope. (8½ x 11 ins.)

STAMPED ON BACK OF STUB IN CHECK BOOK.

DISTRIBUTION

JOB NO.	ACCOUNT NO.	TOTAL	
191	6	1000	
	4	10	
TOTAL		1010	00

DISTRIBUTION

JOB NO.	ACCOUNT NO.	TOTAL	
191	6	1000	
	4	10	
TOTAL		1010	00

STAMPED ON BACK OF CHECK.

XXIV. CONTRACTING PRACTICE.
Check Distribution Stamp.

many jobs are in progress.

Liability Insurance, digested in detail in the September number, almost requires a detail Pay Roll Distribution such as Plate XVIII, inasmuch as the various classifications of labor are rated differently. The contractorr will more than pay for the extra time, trouble and cost to keep a set of distribution books in order to secure the benefit of a closer classification of rates.

At any time the Liability Company's Auditor appears, a complete summary of

the Pay Roll is shown, grouping each class of work in its own proper column. By lumping the Pay Roll, it must bear the maximum rate, whereas, if classified, a reduction is secured in the total premiums paid.

In case of large construction the division of the work by sections is of the utmost importance and it is recommended that each such section be considered the same as a sub-contract and the material and pay roll costs be distributed accordingly. In other words, instead of carrying a job as a complete whole we divide the total into sections in accordance with the original "Outline of Work and Itemized Estimate," (July and August issue), and that a separate account be opened for each section resulting in distinct time and work reports and separate distribution sheets.

By adopting this method the work of the field forces and the office are harmoniously adjusted and the work of the cost analysis at the completion of the contract is very much simplified.

The next article will take up the question of the analysis of the result shown by the field and office bookkeeping system introducing the idea of progress estimates and progress charts.

This analytical study is not only intensely interesting but is of the greatest importance to the up-to-date superintendent inasmuch as through the information furnished by the proper recording of the results of the work, he is able to discover the weak points and divide his best attention to same instead of considering the work as a whole. Without such detail information he is absolutely at a loss to prepare any record, and while the superintendent may be intelligent enough to recognize that certain parts of the work are not proceeding properly, he cannot be as strong a man as where he has the record and every part of the work so tabulated that he can day by day adjust his forces, revise his methods to gain the least cost.

Adaptation of Roads and Pavements to Local Rural Conditions.*

By Nelson P. Lewis, Chief Engineer Board of Estimate and Apportionment, New York City.

SINCE Tresaguet, in France, and Telford and Macadam, in Great Britain, showed, about a century and a half ago, that roads of broken stone were capable of carrying heavy loads and could be made practically impervious to water and proof against the action of frost, the broken stone road has been considered the highest type of country and village highway, and until recently it has been frequently found in city streets. In Great Britain such roads are extensively used by heavy traction engines hauling trains of loaded wagons. This use of traction engines on rural highways is rapidly increasing, Mr. W. J. Taylor, county surveyor of Hampshire, having estimated that there were in use in 1908 about 8,500

*FROM a paper before the American Road Builders' Association—6-PT.

such engines on the highways of England and Wales, or about one to every three and a quarter miles of main road.

By the beginning of the present century progressive countries had set about constructing a more or less complete system of water-bound macadam highways connecting the various centers of population. Within the last decade has appeared the high-speed road locomotive, or automobile, and it soon became apparent that, while water-bound stone roads stood up fairly well under rolling loads, they were not calculated to resist the action of driving wheels, and it is now universally recognized that a different kind of binding material must be used. The technique of modern bituminous macadam construction does not come within the limited scope of this paper, and no further reference will be made to it except as a modern type of road surface, it being assumed that very little macadam is likely to be laid in the future without the use of a bituminous binding material, either by the mixing method or by surface application. While the new type of macadam is calculated to resist the action of self-driven vehicles, the commercial use of such vehicles, which is just beginning in this country both as to the number of vehicles and their carrying capacity, will doubtless increase very rapidly, and this is one of the chief considerations which in the writer's opinion should govern the determination of the type of road to be constructed. The English traction engines already referred to, while slow-moving,

*From a paper before the American Road Builders' Association.

are very heavy and haul wagons with correspondingly heavy loads. This kind of traffic will necessitate the provision of strong surfaces and foundations, and it has been predicted that it will be necessary to place under macadam roads which are likely to be subjected to exceptionally heavy traffic a substantial concrete foundation.

There may in some cases be local prejudice against considering adaptability to motor car traffic in determining the kind of construction to be employed, but it must be remembered that in the State of New York owners of automobiles will during the current year pay into the highway funds of the State in the form of registration and license fees the sum of $900,000, or enough to pay interest and sinking fund on some $18,000,000, and the receipts from this source will doubtless increase rather than decrease. If motor trucks and traction engines are to come into general use, it would be manifestly fair to impose an additional tax upon all vehicles designed for a load of, say, 2,500 pounds or more on each wheel.

Without enumerating in detail the different kinds of pavement available for use in road construction, they may be classified under five separate types, as follows:

1. Broken stone, with bituminous binder, or roads of the macadam type.
2. Finely divided or pulverized mineral matter with bituminous binder, which for lack of a better name may be called roads of the asphalt type.
3. Stone blocks of various sizes laid in courses or in some regular pattern.
4. Artificial blocks in the form of brick, slag, cement concrete or bituminous concrete.
5. Sheet or monolithic concrete.

The problem with which we are confronted at the present time is the creation of a great system of good highways, the aggregate mileage of which will be enormous. Nearly all of these highways will be in rural districts, where the cost of their construction cannot be assessed upon the abutting property. The expense must, therefore, be met by the State or by the State, county and town jointly. The money must be borrowed through the issue of bonds or must be raised when needed by direct taxation. While the annual cost of maintaining these roads will be a serious burden, and this burden should be reduced to the lowest possible amount consistent with efficiency, and while the type of road to be built should be determined with regard to ease and economy of maintenance, the selection of the type of surface will in most cases be controlled by considerations of first cost. Where local stone is available for the entire road or even for the bottom course, and where exceptionally heavy traffic is not anticipated, there will be no hesitation in selecting type No. 1, or macadam with a bituminous binder. If the traffic is considerable, and if a large proportion of it consists of motor cars, the slight additional expense of employing the mixing method will be amply justified, while if the traffic is light and slow-moving, the somewhat cheaper, but in the writer's opinion less effective, plan of surface application may answer the purpose. This type of road where local stone can be used will permit of the building of the greatest mileage with the funds available. The importation of foreign stone at 100 per cent. greater cost to build a road which will last only 50 per cent. longer is not a good business proposition. There are districts where admirable road materials abound, but where the worst examples of roads are also to be found. Again, there are places where there are excellent roads and at the same time no suitable road material. Why is this? It is simply because a competent road engineer who is compelled to do the best he can with indifferent materials has produced better results than the incompetent or careless engineer who fails to use to advantage the better materials within his reach.

There are certain sections where there is no native stone available for road building and maintenance and where the cost of transporting it from distant quarries would be so great as to make a stone road unduly expensive. In such cases the most economical surface to adopt would be type No. 4, or one of artificial blocks. In sections which are devoid of stone it frequently happens that there is material from which excellent paving brick can be made, but if brick are not available other blocks may be used, which may be of slag or of cement or bituminous concrete, while sand or gravel must be supplied as a bed for the brick or blocks, and underdraining will in most cases be essential. In towns which are so located a road surface of the asphalt type may be used, but this pavement as commonly laid requires a concrete or other substantial foundation. It is not improbable that a pavement of the asphalt type will be developed in which the mineral matter, instead of sand or stone, will be loam or clay. The writer has seen samples of such a road surface, which appear tough, malleable and non-slippery, while if suitable material is readily accessible, it is predicted that its cost will be little more than that of a good macadam road.

It is generally recognized that the most durable of all pavements and the one requiring a minimum of erpenditure for repairs is stone block. Under horse-drawn

vehicles with steel tires it is rough and very noisy, and both the horse and the steel tire will be with us for many years. It was but a few years ago that granite or other stone block was considered a proper pavement to be laid upon such streets as Fifth avenue, in New York, or Euclid avenue, in Cleveland, but whether it is due to a greater appreciation of quiet or to more susceptible nerves, such pavements are now considered entirely unsuited to thickly settled communities, except where there is an intensive traffic and in streets largely given over to business and where noise is not a serious objection. The writer believes that stone blocks have not been given the consideration which they deserve for roads where the traffic will be heavy, where noise will not be a nuisance, and where the blocks once laid need not be disturbed. A type of road surface which has given very good results in Europe is that known as "Kleinpflaster," and is a pavement formed of stone blocks approximately cubical in shape, about three inches square on top, and three to four inches in depth, laid in concentric rings or curves with different centers, giving an arch or mosaic effect in appearance. This pavement gives a good foothold for horses, offers little resistance to traffic, is much less noisy than stone blocks laid in straight courses at right angles to the direction of travel, and offers an excellent surface for motor traffic. The cost of such a pavement laid over an old macadam and including the adjustment of the surface is said to be about the same as that of ordinary granite block. On many of the interurban highways of Germany this pavement has been laid to a width of from 15 to 18 feet, and is giving very satisfactory results, while its relative noiselessness makes it unobjectionable on highways where the abutting property is well built up. It is said that pavements of this type have been in use on heavily traveled roads for twenty-five years with practically no expenditure for repairs. Both the ordinary stone block and "Kleinpflaster" have claims to consideration on our rural highways which have not heretofore been recognized.

A type of pavement which has thus far had but limited use is that of cement concrete. Some of this pavement when well constructed of sufficient thickness and on an unyielding foundation has given excellent service, although owing to the personal element which appears to make it very hard to secure uniform results in the mixing and laying of concrete, it is difficult, if not impossible, to guarantee success. If too smooth, these pavements are unduly slippery under certain weather conditions, and they are not suitable, therefore, for heavy grades. It is essential that the concrete should be given ample time to set before traffic is allowed upon it. This is of the utmost importance, and it might not be extravagant to say that each additional day after apparent setting that all traffic can be excluded may add a year to the probable life of the pavement. The latest development in the line of concrete pavements is what is known as oil concrete, where a bituminous oil is added to the concrete before it is laid or is applied to the surface of the concrete after it is well set, as a waterproofing coat. If in addition to the surface application of oil there be also added a coating of fine stone or screenings which is renewed as it wears away, a protecting surface may be furnished which will make concrete pavements more generally satisfactory than they have heretofore been. From a paper by Mr. L. W. Page, presented to the American Society of Civil Engineers on November 1, 1911, describing a series of experiments made in the Office of Public Roads, Department of Agriculture, it appears that the strength of cement concrete decreases as the percentage of oil is increased, while the time required for setting is increased. The resistance to crushing of concrete containing 10 per cent. of oil appears to be about 25 per cent. less at the end of 28 days than that of ordinary concrete without oil. In toughness or ability to resist blows there appears to be little difference between oil-mixed and plain concrete. The most significant characteristic of the oil-mixed concrete is indicated by the absorption test. Plain concrete absorbed more than 6 per cent. of its weight of water in one day, while concrete containing 10 per cent. of oil absorbed 1.5 per cent. in the same time, and it was found that little, if anything, was gained in this respect by increasing the amount of oil up to 25 per cent. It is this low absorption which is the most promising feature of oil concrete.

The writer cannot attempt to specify under precisely what conditions any one of the types of road surfaces which have been enumerateed should be adopted. The object of the paper is to point out in a general way the adaptability of the several kinds of pavements to local conditions and to urge a more careful consideration of their availability, instead of assuming that all country or village roads or all parts of any particular highway should be treated in the same way as every other highway.

The conclusions which have been reached may be briefly summarized as follows:

1. In country highways the chief consideration will be first cost and the cheap-

est suitable material which is available must be used.

2. In roads where heavy traffic and excessive wheel loads are likely the most durable material should be employed and the foundations should be capable of sustaining very heavy loads.

3. Where noise is not a serious objection stone block will be the most durable and economical road surface under heavy traffic.

4. In suburban towns and residential streets a quiet and dustless road surface will be well worth the additional expense involved.

5. In city streets the consideration of cost can properly be subordinated to sanitary qualities quiet and cleanliness.

6. Between and along surface railway tracks the pavement should be especially adapted to the exacting conditions and should be laid and properly maintained by the railway company without public expense.

Municipal Water Purification Plant, Grand Rapids, Mich.*

By J. W. Armstrong, C. E., New York City.

THE filtration plant now being constructed for the city of Grand Rapids is the outgrowth of a project which was first seriously undertaken some twelve years ago. Little real progress was made, however, until 1909, when Messrs. Hering & Fuller were employed to report upon the best available method of securing a new water supply for the city. They advised in February, 1910, the construction of a mechanical filter plant having a capacity of twenty million gallons daily, for purifying the water of the Grand river, and that a complete water-softening plant, together with all the necessary appurtenances, including reaction and coagulating reservoirs, be built for preparing the water for filtration. A clear-water reservoir of three million gallons capacity was also recommended.

The water of the Grand river is a moderately hard water for the central West, and a very hard water, as viewed from the standpoint of waters of the Atlantic seaboard. It is about twice as hard as the water of Lake Michigan. It is frequently uninviting in appearance, partly due to the color or vegetable stain which it contains, and this is augmented at times by soil wash, which produces more or less turbidity or mud in the water as supplied to the consumers. As regards the bacterial analyses, the water, while polluted to an extent that makes it undesirable and at times unsafe for drinking purposes in its raw condition, is certainly not grossly polluted, and can be made entirely satisfactory in quality after being treated in a thoroughly well built and well operated filtration plant.

A brief description of the course taken by the water in its passage through the plant may prove helpful in understanding what follows:

The water passes from the intake into a concrete conduit to the pumping station, where it is picked up by a centrifugal pump and forced into an equalizing chamber in the head house. From here at times of high turbidity in the river, it enters into the grit chamber, where sand and heavy suspended matter is settled out. After passing through the grit chamber it enters a mixing chamber, where the chemicals are applied, and the water is kept in rapid motion until the proper reactions have taken place, when it is admitted into the coagulation reservoirs, where the water is prepared for the filters and most of the impurities are precipitated to the bottom. After leaving the coagulating reservoirs the water passes through the sand filters, and from there into the clear-water reservoir, from which it is finally led through a concrete conduit to the high-lift pumping station.

The pumping station is located centrally and adjacent to the filter gallery. The centrifugal pumps, which are of the single-suction vertical-shaft type, are located in a pit. The pumps are placed with their centers below extreme low water level in the river, which insures their being always primed. There are three raw-water pumps, each capable of lifting eight million gallons a day against a head of thirty feet. There are two smaller raw-water pumps, each of a capacity of four million gallons a day against the same head. On a tee in the suction line of one of these pumps a valve is attached which opens into the room and is operated by an extension stem from the floor above. This enables the raw-water pump to be used as a sump pump should the pit become flooded. The raw-water pumps are designed to be operated automatically, starting when the water falls below a certain level in the equalizing reservoir and stopping when it reaches a certain predetermined elevation. They are also capable of being operated by hand. All the raw water is discharged

*From a paper before the American Society of Municipal Improvements.

into a 36-inch force main laid under the floor of the filter gallery, in which is placed a 36-inch Venturi meter with an 18-inch throat. This arrangement effected quite a saving in the length of piping, but prevented an ideal arrangement of the pipe gallery.

The two wash water pumps each have a capacity of 1,000 gallons per minute against a maximum head of 52 feet. These pumps discharge their water into the wash water main in the center of the filter gallery. They are designed to stop automatically when the water reaches a certain elevation in the wash water tower, but they require to be started by hand. The reason for this method of operation is to enable the exact amount of water required for each filter washing to be accurately determined, which could not be done if water were to be pumped into the tank at the same time it was being withdrawn. The motors operating the pumps are located upon the ground floor, and they will be run by alternating current of 440 volts, transmitted through underground cables from the high-lift pumping station.

The water is pumped into an aqualizing chamber in the head house, which acts as a center of distribution, and from there it ordinarily passes directly into the grit chamber through a 42-inch by 42-inch sluice gate. During flood times the river water contains a great deal of sediment that is extremely desirable to get rid of before applying the chemicals. Most of the heavier suspended particles will be deposited by plain subsidence in traversing the grit chamber, which is 152 feet 8 inches long and 21 feet wide, and will hold about 367,000 gallons.

The mixing chamber is adjacent to the grit chamber and is 44 feet wide by 160 feet long and holds approximately 732,000 gallons. Wooden baffles of the "around-the-end" type are spaced three feet apart for the full length of this chamber. This type of baffle permits the operation of the plant with varying heads of water and offers reasonably good facilities for cleaning and inspection. Water can be drawn from the mixing chamber at four different points through the sluice gates. As the condition of the water changes, the time for chemical reaction can be shortened and lengthened. Should the water be drawn from the gate most remote from the entrance it will have to travel four times as far as it would if drawn out at the first gate and the time for chemical reaction would be correspondingly lengthened. The grit chamber and mixing chamber were designed with flat top and bottom, the bottom being reinforced in the style of a mushroom floor system for the purpose of resisting upward pressure.

There are two coagulating basins. The smaller of the two basins is 88 feet 6 inches by 118 feet 9 inches, and holds 1,134,000 gallons; the larger basin is 118 feet 6 inches by 118 feet 9 inches, and holds 1,452,000 gallons. The basins can be operated singly in parallel or in series. They are covered with groined arches supported by columns. It has been noticed in reservoirs with a few baffles that there is a tendency for water to short-circuit and for the floe to settle out unevenly in different parts of the reservoir. In order to overcome this difficulty and to maintain a more even distribution of the floe, the baffles in this basin are much closer than has been the case heretofore, being fifteen feet on centers. The water is withdrawn from the reservoirs over a skimming weir made of thin stop planks. The object in using the thin planks is to interpose a weak point that would give way should the water suddenly be withdrawn on the opposite side, and thus save the concrete work, which is not designed to withstand a full water load. They offer the further advantage of enabling the water to be taken from various depths below the surface.

A feature of this plant which has saved considerable piping and a number of valves, is the double conduit. The water from the mixing reservoir enters the lower compartment of this passage through one of four sluice gates and from there enters the coagulating basins through a sluice gate. After passing through the coagulating basins the water is taken into the upper compartment and conveyed on to the filters. By-passes consisting of sluice gates opening either into the upper or lower passage are so placed that the raw water may be cut out of the grit chamber and passed directly into the mixing chamber or directly into the coagulating basin, or all of the basins can be by-passed and raw water turned directly into the conduit leading on to the filters. Water that has been passed through the mixing chamber can also be admitted to the upper passage and taken directly to the filters, by-passing the coagulating basins. It is thus seen that an unusual degree of flexibility can be obtained in the operation of the plant.

There are ten filters with a normal rating of two million gallons each, five of which are on each side of an eighteen-foot pipe gallery. The filters are built of reinforced concrete, and are supported directly upon the groined arches which form the roof of the clear-water basin. They are 25 feet by 38 feet outside measurement. Each filter is divided into halves by a center gutter, and there are twelve concrete lateral gutters, sixteen inches wide. In washing, all water is carried off through the lateral gutters, none of it be-

ing allowed to flow directly into the center gutter. Each filter has about 738 square feet of sand area, aggregating 7,344 square feet for the ten filters.

The strainer system is constructed of concrete ridge blocks spaced in rows twelve inches apart across the filter. The end blocks are nine inches wide at the base and have perpendicular sides for a height of five inches, at which height a seat is left for the support of the perforated brass strainer plates, which extend in rows entirely across the filter. For a height of eight inches above the strainer plates the blocks are in the form of a truncated wedge. The space between the ridges is filled with four different sizes of gravel, held in place by a brass wire screen. The water, after passing through the filter sand and gravel, enters the water passages between the ridge blocks, from which it passes into the center collector and from there into the pipe system underneath the filters. In washing the filters the direction of flow is reversed, filtered water being passed rapidly through in the opposite direction.

Filter rate controllers of the Earl type are to be installed. These controllers are constructed in such a way as to respond to the pumps. If the water level in the clear-water basin is lowered, the rate of filtration will increase until a maximum is reached, when all filters will discharge at the maximum rate for which they are set until such time as the water again rises, when the filters will gradually slow down until the clear-water basin is full, and then shut down entirely.

As it would require very large pumps to supply the wash water at the high rate at which it is applied, it was decided to employ an elevated tank for washing the filters, which could be filled by means of small pumps during the interim between washes. This structure is built over the clear-water reservoir and the columns supporting it are carried to solid rock. The tank, supporting beams and columns, are built of reinforced concrete; the exterior is of brick to match the other buildings.

The main body of the head house is 46 feet by 60 feet 3 inches outside, which with the addition of a projection for the tower gives a total floor space of about 3,000 square feet. The building has a basement, ground floor, mixing floor and tower The basement is divided into two parts, one of which receives the water from the pumps and acts as an equalizing chamber and distributing point for the raw water. The other compartment concrushing machinery, and a vacuum cleanbins, together with the elevating and tains the steam boiler and coal storage er. Upon the ground floor are located the various operating stands for controlling the valves and sluice gates and all the chemical controllers. The operating floor contains all the apparatus for mixing and storing chemical solutions. The tower contains the bins for the storage of chemicals and the apparatus necessary for handling and conveying the material. The building is constructed of reinforced concrete with the exception of the outer walls, which are of brick.

From the solution tanks the chemicals will flow by gravity to the controllers which are located on the floor beneath, and after passing through the controllers will flow by gravity to the point of application to the water. The operator is enabled to vary the time allowed for chemical reaction to suit the changing condition of the water. For each of the solutions duplicate controllers of the Earl type are provided. They are all operated in conjunction with a Venturi meter and a master controller which so regulates the depth of solution that the head above the discharging orifice varies in direct proportion to the amount of water passing into the reservoirs through the meter. After the orifice has been properly set the action of the controller is entirely automatic, and however much the quantity of water passing through the system may fluctuate, chemicals in the correct proportion will be supplied. An additional alum controller is provided for furnishing the amount that may become necessary for corrective treatment. Each of the chemical solution tanks is provided with a recording gage, operated by a glass float. The recording device is to be enclosed in a neat glass case supported on a bracket on the outside of the tank.

For agitating the chemical solutions each of the tanks is equipped with a two-bladed propeller mounted in a funnel-shaped casing, with its bottom edge supported three inches above the floor of the tank. The propeller will be operated by an electric motor hung from the under side of the tank. The agitation is violent and keeps all inert or undissolved matter thoroughly in suspension until it is drawn off into the piping system. The agitation is particularly good in the corners of square tanks.

In April, 1910, the city of Grand Rapids by vote authorized a bond issue of $400,000 to pay for the new water works project, and of this amount, $350,000 was to be used for the filtration plant proper and $50,000 for conduits and some additional machinery to be installed in the main high lift pumping station.

The work of constructing the filtration plant was divided into four separate contracts, the first of which was for building the clear-water conduit, intake and drain. It involved the construction of

about 2,900 lineal feet of conduit and was awarded to J. P. Rusche in July, 1910, for $51,518.44. Contract No. 2, for the furnishing and installing of all pumping machinery was awarded to the Fort Wayne Electric Company, who coupled to their motors pumps made by the Buffalo Steam Pump Company, the contract price being $12,425. Contract No. 3 was for the various basins and substructures of the buildings. It included practically all the grading and the bulk of the concrete work. This contract was awarded to Prang & Co. for $123,842. The fourth contract was for the construction of buildings, wash-water tower, filters, piping, and all the special devices employed in the plant. The Roberts Filter Manufacturing Company, of Philadelphia, were awarded this contract for the sum of $159,882.

All plans for the construction of this plant were prepared by the firm of Hering & Fuller in their New York office, and since the dissolution of the firm. George W. Fuller has been employed as consulting engineer on the construction of the works. The construction has been done under the general supervision of Samuel A. Freshney, secretary and general manager of the Board of Public Works of Grand Rapids, Mr. R. E. Harrison being the resident engineer in direct charge of the work.

Practical Road Building.*

By John N. Edy, C. E., Highway Engineer, Billings, Mont.

Fundamental Principles of Road Building.

CONTRARY, perhaps, to the prevailing public opinion, road building is based upon certain definite principles, the observance of which is essential to economic results. No matter to what extent experienced road builders may differ as to other and less important details, they are absolutely agreed as to the primary laws that underlie all successful highway improvement. These principles may be stated as follows:

1. Drainage.
2. Compact foundation.
3. Suitable, compact and waterproof wearing surface.

The process of making a road in accordance with these laws is divided into three separate and distinct operations, namely:

a. Location.
b. Construction.
c. Maintenance and repair.

The results to be attained are service and economy.

It is evident, then, that if we are to make the most of our road funds the work must be planned to give the best service for the least money; and it follows that a careful observance of the primary laws noted above will provide these desirable results.

a. *Location.* Undoubtedly many miles of road are in bad condition and expensive to maintain because of poor location. This is due largely to the practice of establishing a road on a section line without considering the practicability of such route. True, if enough money is spent on construction, these poorly located roads may be made good. But it must be remembered that cheap right-of-way plus excessive cost of construction and maintenance is not economy. And no matter what the present needs of the community, there is always the probability of the future improvement of a road, at which time faulty location must be remedied at undue expense. For this reason a location must be feasible from the standpoint of future as well as present economy.

Assuming that the transportation requirements will be satisfied, the best location for any highway is that which—

1. Provides the best drainage.
2. Provides the best foundation.
3. Has most desirable grades.
4. Is nearest a suitable material for surfacing.
5. Has least number of stream crossings.
6. Provides the greatest safety for the traveling public.

Note that the length of the road is not considered. The road builder must realize that, so far as economical transportation is concerned—and that is the aim of any improvement—distance is measured in time rather than in miles. It must not be presumed, however, that directness of route is to be disregarded. Unquestionably a short good road is preferable to an

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equally good road of greater length. The point is that directness is a secondary matter; the permissible load is of more importance than the distance.

The road being in uniformly good condition, the load that may be hauled is determined by that which may be hauled up the steepest grade. For instance, it has been found that if a team can draw two thousand pounds on a level roadway, it can draw approximately—

1,800 pounds up a 1 per cent. grade.
1,600 pounds up a 2 per cent. grade.
1,000 pounds up a 5 per cent. grade.
600 pounds up a 10 per cent. grade.

A 1 per cent. grade means a rise of 1 foot in 100 feet.

A 5 per cent. grade means a rise of 5 feet in 100 feet, etc.

The above figures may not apply strictly to very short grades, but from them we may get an idea of the desirability of easy grades. Thus any means of establishing a proposed road without regard to the topography of the country must result either in decreased service or increased cost of construction. For, if a maximum grade of 5 or 6 per cent. is to be obtained, we must either resort to expensive excavation or avoid the hill by going around instead of over. Furthermore, side-hill construction is usually cheaper, the drainage is more easily accomplished and a wider choice of foundation is presented.

The question of maximum grades is determined largely by local conditions; as, for instance, the kind of traffic, the direction of heavy hauling, etc. An effort should be made, however, to secure as nearly a level road as is practicable. It has been stated in this connection that no roadway should be built perfectly level. This is not necessarily true. A well-maintained roadway will drain to the side ditches, which, if properly constructed, will have sufficient fall to remove the water coming into them. "Seepy" places in side-hill work may be avoided by shifting the road up or down the side of the hill, or by passing around the other side. Such places at the foot of a heavy grade in a deep cut may only be removed by sub-drainage.

We may assume that the less the cost of surfacing a road with gravel or stone, the sooner such improvement becomes possible; and the nearer the surfacing material to the road, the less the cost of placing it. It therefore follows that the otherwise satisfactory route should be selected that renders available a good deposit of stone or gravel. And, finally, because bridges and culverts are expensive, the fewer such structures required the less the cost of construction and maintenance. Railroad companies spend vast sums of money in order to avoid unnecessary stream crossings. It may be, and often is, possible to build a mile of good road for the cost of one bridge. The wise course is to build permanent structures, but to build only when necessary. The reader can no doubt recall instances of section-line location that require one or more useless bridges that are costly and a constant source of expense and annoyance.

Too often, especially on side-hill work, the road is located and constructed without regard for the safety of the traveling public. On account of the advent of the swiftly moving automobile, if for no other reason, it is imperative that excessively sharp turns and unprotected steep banks be eliminated.

From what has been said it may be seen that under no circumstances should a road be established without first having made a careful inspection of the several possible routes, and the final location determined only upon a thorough consideration of the conditions that affect its cost and value.

b. *Construction.* The construction of the road involves—

1. Staking out.
2. Clearing, grubbing, etc.
3. Grading—that is, excavating and filling.
4. Building the foundation.
5. Shaping the surface, or machine grading.
6. Placing the surfacing material.
7. Placing the bridges and culverts.

Inasmuch as hard-surfaced roads are placed on an earth foundation, the construction of a good earth road provides the foundation for any future improvement. That is, the construction of a macadam road is merely the placing of the surface material upon the previously built earth road as a foundation, assuming that proper grades have been established. The importance of the common earth road can hardly be over-estimated, and will be treated later.

Referring to the notes on location, it is evident that if these ideas are to be carried out the work must be staked. The final location of the line should be surveyed and marked by placing satisfactory monuments at angle points, etc. Stakes showing the cut or fill should be placed at distances varying from 25 feet to 100 feet. No supervisor can move earth economically by eye, and as the most expensive feature of earth road construction is the excavation, every effort should be made to eliminate unnecessary cost. Furthermore, no clearing can be properly done unless the boundaries of the right-of-way are plainly marked. Grading should be conducted by the use of proper tools and

machinery; the selection of the proper earth-moving device materially reducing the cost of such work. The road surface is shaped with a grader, such a design of roadway having been selected that will require the least amount of hand labor.

No highway may be considered improved unless bridges and culverts have been correctly designed, properly placed and built of durable material. No fill should be made on a wooden culvert because of the expense of replacing. These features will be treated under their respective subjects.

c. *Maintenance.* It is plainly uneconomical to make expenditures for highways and then fail to maintain them in good condition; not only is it uneconomical, but no road can render the service for which it was intended, except that it be kept in a serviceable condition. While it is not proposed to go into the maintenance of the several kinds of roads at this point, it is desirable that the reader's attention be called to the necessity of preserving the solidity of foundation and waterproofness of wearing surface. Unless this is done and the bridges and culverts are inspected and maintained, the value of the investment will be decreased and the safety of the traveling public impaired.

In later articles will be outlined briefly the methods of properly doing such road building as may devolve upon the supervisor. The reader must bear in mind that the essential requisites of a good road are service and economy, and that these are only attained through a proper observance of the principles outlined above.

The Municipal Power Plant of Richmond, Va.

Editorial Correspondence.

RICHMOND, Va., has recently completed and put in operation a most economical and efficient municipal electrical plant. The location of the city allows of the use of the James river for power purposes and the foresight shown in securing and making use of this factor indicates a progressiveness in municipal affairs very creditable to the city.

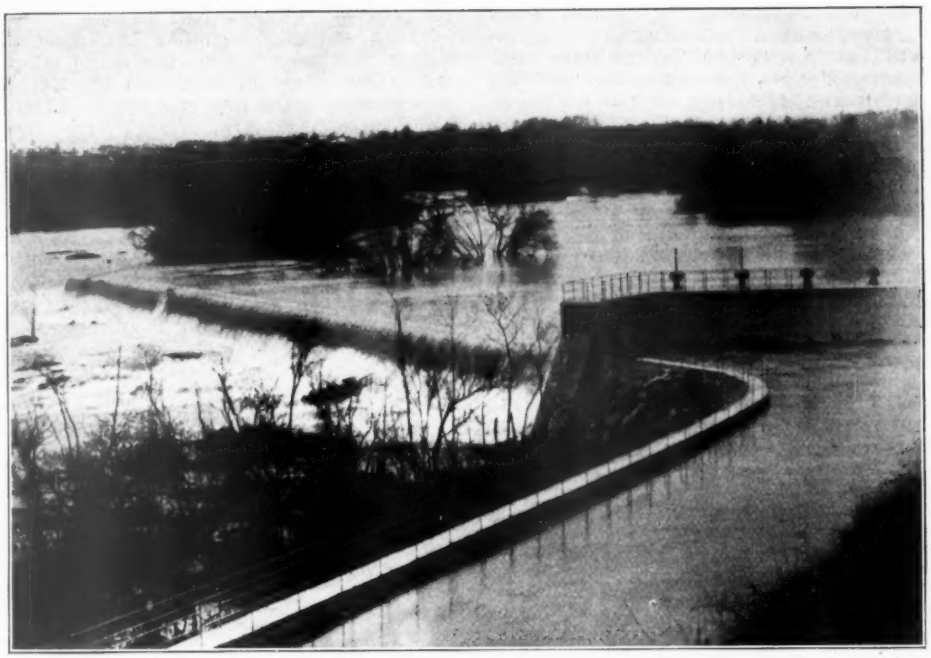
The first movement to secure a municipally owned electric plant in Richmond originated in 1888, but an indifference was shown which resulted in the failure of the project. In 1907 circumstances not directly connected with the question of electric power again brought the matter up for consideration.

The city of Richmond derives its water supply from the James river, two plants being operated by water power and pumping into inependent distribution systems. It became necessary, by reason of the danger of pollution at the lower or old pump house, to pump all the supply from settling basins constructed at the upper pump house. This procedure would have rendered the lower station of no practical importance and its abandonment would have been necessary. The question of converting the water power at the lower station into electrical energy and transmitting it to the upper station for pumping purposes then presented itself. At this stage E. W. Trafford, consulting engineer of Richmond, was retained to make an investigation and return a report covering the situation and regarding the possibilities of an electrical power plant at the old pump house.

The possibilities of generating electrical power more than sufficient for pumping purposes led to the consideration of a municipal power plant, which would furnish power for street lights and possibly for private use as well. The consideration of this matter caused a great deal of opposition from many of those who did not approve of municipal ownership, and from the local utility interests and several of the newspapers of the city.

At that time the electrical field was controlled by the Gould interests, who, from a hydraulic plant located near the old pump house, furnished energy for the street railway, street lights, power and private use. The lighting system at that time consisted of about 1,000 arcs of the old type, 1,200 candlepower, 6½-ampere class. For this service the city was paying a yearly rental of $54.75, and all of the current was supplied by means of overhead wires.

In the very complete report which Mr. Trafford presented a careful comparison was drawn between the lighting conditions in Richmond and in other cities of the country. The private lighting company had endeavored to show that Richmond was securing service at a far lower rate than most cities, but in his report Mr. Trafford stated that considering the class of lights furnished, Richmond was in reality paying an exorbitant rate. A comparison of the cities of Chicago and Richmond, in which an equal illumination and the same number of hours of lighting was considered, showed that the Chicago



DAM AND HEAD RACE OF THE RICHMOND, VA., POWER PLANT.

GENERATORS AND TURBINES OF THE RICHMOND, VA., POWER PLANT.

plant was furnishing light at $87.94 per light per annum, including the cost of the plant, while Richmond on the same basis was paying $90. A comparison between Detroit and Richmond on the Richmond basis of lighting showed an annual cost to Detroit of $37 per light as against $55 for Richmond.

The rates for power were shown to be correspondingly high, as is noted in the following table, in which a comparison is drawn using corresponding loads of 1, 5, 40 and 100 horsepower during 9 hours per day of 300 working days per year:

—1 Horse Power—

	Per h.p. per annum.
Richmond, water power	$292
Charlotte, N. C., water power	144
Anderson, S. C., water power	81
Durham, N. C., steam power	120

—5 Horse Power—

	Per h.p. per annum.
Richmond, water power	$120
Charlotte, water power	60
Anderson, water power	60

—40 Horse Power—

	Per h.p. per annum.
Richmond, water power	$72
Charlotte, water power	36
Anderson, water power	24

—100 Horse Power—

	Per h.p. per annum.
Richmond, water power	$54
Charlotte, water power	36
Anderson, water power	20

Although it was not intended to furnish electricity for private lighting and such a step has not been taken up to the present time, Mr. Trafford's report showed that the city could furnish such current at the rate of 5 or 6 cents per kilowatt hour as against the following prices obtained by the company:

57 per cent. of all customers paid an average of 9.7 cents per kilowatt hour.

14 per cent. of all customers paid an average of 9.1 cents per kilowatt hour.

8 per cent. of all customers paid an average of 8.6 cents per kilowatt hour.

4 per cent. of all customers paid an average of 7.9 cents per kilowatt hour.

1½ per cent. of all customers paid an average of 6.6 cents per kilowatt hour.

4½ per cent. of all customers paid an average of 6 cents per kilowatt hour.

2½ per cent. of all customers paid an average of 5.8 cents per kilowatt hour.

6½ per cent. of all customers paid less than 5.8 cents per kilowatt hour.

These figures of costs and comparisons led to the decision to construct a municipal power plant to furnish electricity for street lighting and power purposes. The site suggested for this plant was the old pump house, which it had become necessary to abandon. Among the reasons which had been stated for abandoning this plant were the fact that the plant was located at the foot of a hill on which were located the three cemeteries of the city. In order to make use of the plant it would have been necessary to convey the clear water from the upper pump house and repump it with the obsolete machinery at the lower station. The old pump house site was accordingly proposed; it being proposed to generate power for use at the upper station as well as for street lighting purposes.

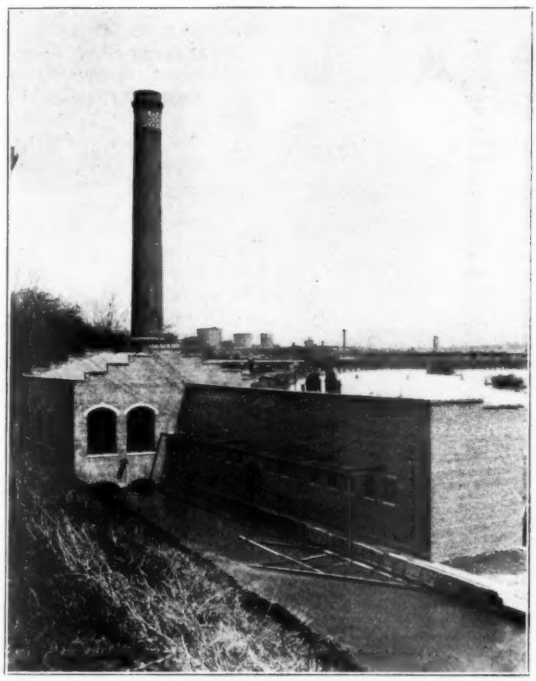
After considerable delay and much discussion Mr. Trafford's report was adopted and a bond issue of $250,000 was passed to provide funds for the construction of the plant. Additional bond issues of $100,000 for water works improvements and $85,000 for a distribution system were also provided.

The history of the acquisition of the water power rights by the city of Richmond is interesting in this connection. As early as 1840 the city realized the value of the water power and obtained the right from the legislature to sell or lease power. The original right to the water power was obtained from General J. B. Harvie, a wealthy land owner, in 1840, when he conveyed to the city of Richmond "the lands, dams, wells, islands lying between James river and Kanawha canal and Belle Isle, and also the land on the north shore of James river (described by certain boundaries), with all rights and privileges." He also obtained from the General Assembly an act confirming his rights and giving the right to raise the existing dam twelve feet above its present height and "to construct a wing dam on certain rocks and islands to a flat rock nearly opposite the waste of Ruthersford Mills."

The search of the old records telling of this grant and the succeeding efforts to relocate the old marks and boundaries described, led to a number of interesting occurrences. The extremity of the wing wall described was fixed by a "flat rock marked with the letter H." Three surveys were made under Mr. Trafford's direction, with the object of locating this "flat" rock, which was supposed to be some rather prominent mark on a certain island. At the termination of the third unsuccessful survey it was decided to relocate the point near a small rock near where it was supposed that the marker had been placed. One of the party, who was standing on this rock, asked that a board be thrown across to allow him to step ashore, and when he stooped to place this board he discovered a moss-grown H chiseled on the face of the rock. This settled beyond all dispute the limits of

the city's wing dam. Photograph 1 shows the head race, dam and wing dam running out to the islands in the background.

In constructing the new plant every possible use was made of the then existent old pump house. The old dam, twelve feet in height, was raised to eighteen feet and the head race walls reconstructed to give the needed additional height. The old walls of the pumping station were made use of, the new turbine wheels being set into the niches formerly occupied by the underflow water wheels of the old pump house, while the walls were built up to allow more head room.



THE RICHMOND, VA., POWER PLANT.

Only a few changes were made in the tail race.

A thoroughly new and up-to-date station building was constructed, a new wing being necessary to accommodate the boilers for the auxiliary steam-driven turbines. The old pump house walls were built up to a greater height and more floor space was provided for the switchboard and transformer equipment.

A careful study was made of the water power possibilities of the plant and the class of machinery chosen and the provisions made for utilizing all available energy are a tribute to the foresight and ability of Mr. Trafford. The hydraulic equipment consists of three 42-inch Morgan-Smith turbines, directly connected to General Electric revolving field generators, 60-cycle, with a capacity of 425 kilovolt-amperes at 150 revolutions per minute, and equipped with a Lombard governor. An additional unit is being installed at the present time with a view towards a possible extension of the system, though the present equipment is fully adequate for present conditions.

The auxiliary steam-driven machinery consists of two 500-k.w. generators of the revolving field type, direct connected to two 750-k.w. generators, making 1,800 revolutions per minute. The turbines operate condensing, a vacuum of 28 inches being obtained in the Alberg barometric condensers.

The starting arrangement on the exciter is very ingenious. The exciter system consists of two 50-k.w. motor generators. A Pelton water wheel is direct connected to the exciters, water being furnished to the wheel from an old disused main (part of the old pumping system), which extends back a mile to the new pump house reservoir. This main furnishes water under about 120 feet head, so that in order to start the exciter

system it is necessary only to admit enough water to turn the water wheel and start the exciters.

The boiler equipment consists of two 400-h.p. Babcock and Wilcox boilers. They are not equipped with superheaters.

The generator equipment is star-connected, delivering either 2,300 or 2,400 volts. Eleven 100-light constant-current transformers of the latest type have been installed and two additional units are at present being set up. The switchboard provides for twenty 50-light arc circuits.

ORNAMENTAL LIGHT STANDARD IN RICHMOND, VA.

The pumping equipment installed at the upper station and operated by power transmitted from the new plant consists of four four-and-a-half-million-gallon De Laval two-stage centrifugal pumps, direct connected to 200-horsepower 600-volt Westinghouse motors. The output from these pumps averages between ten and eleven million gallons per day; and for six months of the year all of the water used by the city can be pumped by this electrical system.

The first installation of street lights under the new system provided for about one thousand alternating current series enclosed arc lamps, requiring 7½ amperes in the place of 6½ amperes as did the old lamps. The major portion of the distribution system was over-head work but in the downtown district 65 lamps were supplied through lines laid underground in Orangeburg fibre conduit of the most improved pattern.

After the installation of the plant, the question of ornamental street lighting was agitated and as a result the nucleus of a most up-todate system has been constructed. The first appropriation of $25,000 was expended in placing the boulevard lights along Broad street, one of the main business streets and the most quaintly characteristic street of the city. The first installation consisted of eighty 5-lamp standards equipped with ball globes, all erect, and 100-watt tungsten lamps. An additional appropriation of $15,000 for 65 new lamp standards and equipment has been made. The lamp standards are of attractive design and well chosen as regards weight and height. They were furnished by the Morris Iron Works of New York City. The great distance between curb lines has made the problem of adequate illumination on Broad street very difficult, but the city is to be congratulated on the good taste shown in allowing a liberal distance (100 feet) between standards, making the light spacing uniform in both directions. The effect secured is not that of a glare over the entire street, but rather a subdued light, with, however, more shadow spots than would be necessary had the street been narrow enough to allow of a less distance between standards.

Though the new plant has been in operation only since January 1, ample evidence has been given of its success. In the place of an abandoned pump house site, the machinery of which was so obsolete as to be almost worthless, and a dam and property purchased for $50,000, the city now possesses a thoroughly up-to-date, efficient electric plant valued at $300,000. This plant is at present pumping from ten to eleven million gallons of water per day and furnishing current for almost 1,000 street lights in Richmond and about 150 arcs in the suburb of Manchester, which recently applied for current. The kilowatt output for the first seven months of operation is given as follows:

Month	Water Dept.	Broad Street	Street Arcs	Total Output
January	172,787	11,241	.....	188,082
February	247,400	8,835	.....	256,235
March	267,010	10,284	.....	277,294
April	261,830	8,416	43,730	313,976
May	299,270	8,133	38,846	446,249
June	233,590	7,190	135,582	330,322
July	187,550	7,190	135,582	330,322

As nearly as can be estimated at the present time, the arc lights at present used by the city, which are much superior to those which were furnished by the

private corporation, are costing about $33.00, including all interest and depreciation charges. The cost to the city under the old system was $54.75 per arc per annum. The saving in this department, taken together with that in the water department, is expected to amount to about $30,000 a year. In addition to these items, the indirect effect of the more improved street lighting in the downtown section, and the possibilities of further extension of the power facilities to public buildings and other uses, are additional evidences of success of the plant and the foresight of its projectors.

ORNAMENTAL LIGHTS ON BROAD STREET, RICHMOND, VA.

The Barrington, R. I., Experimental Road.

Editorial Correspondence.

DURING the time that Arthur H. Blanchard was in charge of bituminous road construction in Rhode Island, an interesting experimental road was constructed between West Barrington and Nayatt Point, near Providence. This road, built in 1909, has been open to traffic about two years, and some comment was made upon its condition in January, 1911, at a meeting of the American Society of Civil Engineers.

The road offers a comparison between different materials, all applied by the mixing method and with a flush coat spread after the mix had set. The subgrade was uniform throughout, consisting of a hard layer of clay and sand over a foundation bed of bricks which had been placed on the road some time before by local authorities. The grades vary from 0.50 to 1.14 per cent. and a very uniform condition of shade prevails along practically the entire length of the experimental section. The conditions of laying the material were made as uniform as possible and the macadam was the same over the entire section.

The macadam was built in two courses: The foundation course consisted of broken stone varying from 1½ to 2¾ in. in longest dimensions, which was 6 in. deep when loose, and was rolled to 4 in. The top course consisted of stone of the same quality, varying in size from ¾ to 1½ in., which was 3 in. deep when loose, and was rolled to 2 in. The rock used was a chlorthe gneiss, having the following characteristics:

Determinations.	Results.
Specific gravity	2.80
Weight per cubic foot	175 lb.
Water absorbed per cubic foot	0.46 lb.
Percentage of wear	4.6
French coefficient of wear	8.6
Hardness	15.7
Toughness	8
Cementing value	Fair.

The width of macadam was 14 ft. and the crown throughout was ¾ in. per ft. The top-course was mixed by hand with bituminous material until all stones were thoroughly coated. Most of the mixing was done by hand, with long-handled, square-pointed shovels, on plank platforms composed of three sections, each 8 ft. square. A tar-coating machine was used on the sections built with Springfield-Tarite and the U. G. I. No. 4 Road Compound. The mixing gang consisted of three experienced and five common laborers. In applying the flush-coat house brooms were used, the material being supplied to the spreader in steel-bodied wheelbarrows.

A traffic count was made during the months of June and July, 1909, and the following is the average for 8 hours:

Horse drawn vehicles	
One-horse vehicles	71
Two-horse vehicles	3
Motor vehicles:	
Motor cycles	1
Motor runabouts	9
Four or five passenger motor cars	43
Six or seven passenger motor cars	17

From this it will be noted that the traffic is very light during the summer months.

The experimental road contains only six sections, but adjoining it at one end is a section of crude tar mix with an asphalt flush coat, and at the other a section of tar and asphalt mix with an asphalt flush coat and a section of crude tar mix with no flush coat. These divisions will be noted with the six evperimental sections. The following comment is made as a result of an inspection on August 27,1911:

The first section is of crude tar mix with an asphalt flush coat and was built according to the standard specifications for bitumnious roads, then in use by the state. The surface showed the marks of horses' hoofs, though the temperature was only about 80 degrees. There were, however, no traces of excess asphalt, nor evidences of "bleeding" and the surface was smooth and firm enough to resist the distributed weight of wheels. Photograph 1 illustrates this.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
I. Crude Tar with Asphalt Flush Coat.

The second division is the first of the experimental section. It consists of 275 feet treated with U. G. I. Road Compound No. 4 which is a water gas tar manufactured by the United Gas Improvement Co. of Philadeplhia. In commenting on the laying of this section, Irving W. Patterson, resident engineer in charge, states:

"The first section laid with this material was allowed to remain over night before rolling, but this section was never compacted as well as where rolling followed close after the laying of the surface. Rolling in the early morning appeared to affect the surface in no way except to break up the stones of the No. 2 course. Rolling in the middle of the day, except on the day on which the material was laid, appeared to be but slightly more effective than rolling in the early morning. Hence it was found absolutely necessary to roll very soon after laying the No. 2 course. The great change produced by relatively slight changes of temperature can be judged from the fact that in the early morning at this season of the year the material in the barrels might be split with an ax, while earlier in the season it would flow from the bungs."

This section was hard, smooth and showed no hoof marks. The surface resembled a mosaic floor in appearance, as all excess of flush coat had been worn away, leaving the stones exposed but held firmly in place. Photograph 2 shows the appearance of this section.

Springfield (Mass.) Tarite was applied over a distance of 291 feet to form the third section. Rolling was done in the warm part of the day, as the material stiffened and did not compact well during the cold mornings and evenings. About two gallons of Tarite per square yard was used in the flush coat and about ⅝ gallons per square yard was used as a flush coat. Photograph 3 does not give a fair idea of the surface, as the flush coat was worn away and the binder was beginning to wear from between the stones indicating probable trouble. The surface was hard and smooth.

The fourth section consists of Tarite asphalt (10%) applied in the mix and a flush coat of the same material. Two gallons per square yard was used in the mix and a paint coat of ⅝ gallons per square yard was applied after the base had been thoroughly rolled. It was necessary, owing to the low temperature and stiffness of the mix, to prepare very small batches at a time and roll it on the day it was laid. At the end of two days the mix was set sufficiently to allow painting. This section had not worn as well as any of the previous sections noted, as the binder had worn away from the edges of the stones to a depth of a quarter of an inch or more, indicating that disintegration would result, though it had not as yet started. The surface was hard and dustless, with no excess of flush coat. This latter condition may be noted from Photograph 4.

BARRINGTON, R. I., EXPERIMENTAL ROAD
II. U. G I. Road Compound No. 4.

Section five, 168 feet in length, was constructed of Tarite-Asphalt (20%,) the same quantity of bituminous material being used as in the previous case. There was some difficulty in removing the material from the barrels due to its high viscosity, but the conditions of rolling and

BARRINGTON, R. I., EXPERIMENTAL ROAD.
III. Springfield Tarite.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
IV. Tarite Asphalt, (10 Percent.)

the length of time required for setting were practically the same. This material was hard, smooth and dustless and showed less wear of the material from between the stones, though the flush coat had been entirely worn away. It was very similar to the Springfield Tarite section in appearance.

The sixth section was constructed of Texaco macadam binder, only 1¾ gallons of material per square yard being used in the mix and ⅝ gallons applied to each square yard as a flush coat. Mr. Patterson in commenting on the conditions prevalent during the time this section was laid says:

"The weather conditions during the construction of this section were the most unfavorable during the entire period of construction. Owing to frequent rains and almost constant mists, it was impossible to keep the stone dry. Work was carried on, however, except when rain was actually falling, because of the lateness of the season and the desire to finish to a certain point before weather conditions prevented further construction. It was difficult to get the stone coated owing to its wet condition and the mix was exceedingly slow in setting up. It was impossible to apply the flush coat until three weeks after laying the stone."

Although the material had shown softness at the time the flush coat was applied, at the time it was inspected two years after construction it showed no softness whatsoever, was hard, clean, and showed no excess of flush coat, and no dust. Its condition may be judged from Photograph 5.

Section seven was constructed of a Malden (Mass.) Tarite mix in which 1⅝ gallons of bituminous material was used per square yard, and a flush coat of ⅝ gallons was applied at the end of 6 days. Rolling was done each day until a thorough compacting had been effected. The surface at the time it was inspected presented a mosaic appearance, was hard, clean of excess binder and dustless and the material was held firmly in place. Photograph No. 6 shows the appearance of the surface.

The two sections beyond the Malden Tarite do not belong to the experimental road, but nevertheless possess some points of value which justify their mention.

The first of these, section eight, was constructed of a tar and asphalt with a heavy tar flush coat. At the time it was inspected the temperature was only about 80 degrees, yet the surface was so soft as to be readily marked by the prints of horses' shoes, and near one end, which was on a grade, the surface was spongy and had commenced to crack and disintegrate.

Section nine was constructed of crude tar without a flush coat. This entire section had gone to pieces leaving great hollows filled with loose stones which appeared to have only a coating of soot and dirt rather than any traces of binder. It had been necessary to rebuild one portion of this section, near a bridge, in order to make the road passable. The rest of the section was passable but doubtless very unpleasant to ride over.

At the present time the experimental road does not offer basis for accurate comparison of the materials used; but it is evident that another year's wear will serve to intensify the differences which are becoming apparent, to a degree that will admit of definite conclusions being stated. One factor which renders this experiment of greater interest is the fact that the traffic, while rather light, consists principally of motor vehicles, and by reason of the few horses along the line of the road and the excellent surface offered, most of these motor cars pass over the road at a high rate of speed. The result of this high speed automobile traffic on the various bituminous roads constructed in this section will be noted when the experiment is completed.

The following table of cost data compiled by Professor Blanchard gives the costs of each of the materials noted, exclusive of the macadam:

Material.	Material per gal., f. o. b.	Freight, per gallon.	Loading and hauling, per gallon.	Material on road, per gal.	Heating material, per gal.	Mixing material, per gal.	Painting, per gallon.	Total cost of material in place, per sq. yard.
Malden Tarite	$0.080	$0.010	$0.007	$0.097	$0.008	$0.029	$0.021	$0.297
Texaco Macad. Binder	0.110	*	0.005	0.115	0.008	0.030	0.021	0.357
Tarite Asphalt (20%)	0.098	0.009	0.004	0.111	0.008	0.026	0.033	0.383
Tarite Asphalt (10%)	0.092	0.009	0.004	0.106	0.008	0.028	0.036	0.376
Springfield Tarite....	0.080	0.009	0.004	0.093	0.007	0.043	0.032	0.369
U. G. I. Road Compound No. 4.....	0.070	0.025	0.003	0.099	0.007	0.044	0.037	0.391

*Price per gallon includes freight.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
V. Texaco Macadam Binder.

BARRINGTON, R. I., EXPERIMENTAL ROAD.
VI. Malden, Mass.. Tarite.

The Water Filtration Plant at Toronto, Ont.

THE filtration plant which is just being completed at Centre Island, Toronto, affords a typical example of the use of concrete in this type of construction. It is possible to conceive that the tremendous strides which have been made in the methods of purifying the water of municipalities would not have taken place if such a material as concrete had not been available. An idea as to the extent of the use of concrete may be obtained by noting that the plant is constructed practically entirely of concrete, covers more than twelve acres, and to date more than 45,000 cubic yards have been placed.

While this Toronto plant is the first of any magnitude in Canada, similar plants are in operation at Pittsburgh, Philadelphia, Washington, Albany and other places. In 1896 the eminent English engineer, Mr. Mansergh, recommended that the city of Toronto obtain their supply of water from Lake Ontario and filter the same before delivering to the city. The condition of the water supply in Toronto was so poor that in the early part of 1909 action was taken, and in May of the same year the contract for the complete plant was awarded to Messrs. Dill, Russel & Chambers, of Toronto, while Mr. Allen Hazen, of New York, prepared the plans for the city and has been retained as consulting engineer.

Although laboring under many difficulties the contractors have executed a remarkable piece of work and the economical methods of handling the concrete from the time it left the Ransome mixers until it was placed have been the subject of much comment.

The filter beds are 312 feet by 117 feet each, six of them being located on either side of a central court, in which are situated the regulating houses, the entrance houses, the mechanical sand washers and the sand storage bins, together with the great number of pipe lines, varying in diameter from 72 inches down to 24 inches. At one end of one row of the filters is located a pure water reservoir 312 feet square, from which the filtered water is taken to the city.

All of the filters and the reservoir have concrete groined arch roofs, inverted groined arch floors, concrete piers, division walls and outer walls. The piers in the filters are spaced 13 feet on centers and are square. In the pure water reservoir the spacing is the same, and an idea as to the large number of piers erected in this entire work may be obtained by observing that in the reservoir there are 529 and 2,208 in the 12 filters. The height of the reservoir is 13 feet, while the walls are 14 feet high and average 3 feet in thickness; the corresponding figures for the filters being 11 feet and 3 feet 3 inches. For purposes of ventilation concrete manholes, made with the steel forms, have been erected in the center of every other square of the columns, being spaced 26 feet centers both ways, and it should be noted here that the facilitation for placing material inside of the filters were increased by their use.

The concrete was generally mixed in proportions of one barrel of Portland cement, 7 cubic feet of sand and 12 cubic feet of ballast, ranging from ¼ inch to 2 inches. By an endless cable side dumping cars were hauled from the lake shore, where were located the sand piles and the stone screens, to either one of two Ransome mixing plants. Here the material was elevated by tower arrangement into the bins over the mixer superhopper. Concrete was discharged from the Ransome mixer onto a platform with chutes leading to the cars. With this arrangement continuous mixing was possible. The system of industrial tracks was very extensive and the transporting of the concrete was done economically. The shifting of the tracks was promptly effected whenever necessary and as the work advanced the track was shifted from one finished roof to another.

As to the general operation of the filters it may be said that from the low-lift pumping station located on the lake shore side of the filters the water is forced through a 72-inch reinforced concrete pipe from which 36-inch reinforced branches are taken off at right angles to the inlet chambers under each entrance building, each branch supplying two filters. Upon entering the filters the water is spread over the surface of the sand to a depth of 36 to 48 inches and then successively passes through 3 feet 6 inches of specially cleaned and graded sand and three layers of broken stone and gravel. These gravel layers consist of, first, 7 inches of 2-inch broken stone or gravel; second, 2½ inches of 1-inch gravel, and, third, 2½ inches of ⅜-inch gravel, each size being carefully washed and graded.

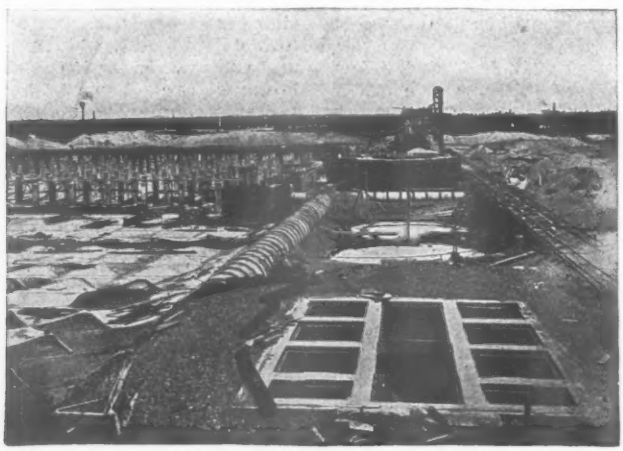
After percolating through these materials the filtered water is collected in 10-inch split tile pipes laid in parallel rows at intervals of 13 feet at right angles to and emptying into a main drain concrete box 6 feet wide. These drains

I. THE WATER FILTRATION PLANT AT TORONTO, ONT.
Concrete Mixing and Distributing Plant in Background, Left of the Center.

are covered with a reinforced concrete slab and empty into 24-inch cast iron effluent pipes, one of which leads from each filter to a regulator house. Each of these pipes is provided with a Venturi meter. After passing through the regulator house the water is then delivered by 64-inch and 72-inch concrete pipes to the pure water reservoir previously described. From this point it connects with a 6-foot steel pipe which runs across the island to the tunnel leading under the bay and thence connecting to the main pumping station on the Toronto shore.

The regulator houses, which are of concrete and of a cellular construction, will play a very important part in the operation of the filtration plant, inasmuch as they contain the outlet pipes and controlling gates of the several filters, and devices not only for obtaining an accurate measurement of the water's velocity through the filters, but also operation of any number of filters at one time as well as the flow of the filtered water to the pure water reservoir.

For the operation of the filters a constant supply of washed sand has been provided and for the storage of the same four circular bins have been constructed, each of which has a capacity of 512 cubic



II. THE WATER FILTRATION PLANT AT TORONTO, ONT.
Filter Beds and Clear Water Basin Under Construction on the Left.

yards, the inside diameter being 34 feet and the depth 21 feet. The sand will be removed from the filters by portable ejector hoppers delivering it through wrought iron pipes to sand washers. After being washed the sand will be delivered by ejectors to the above mentioned bins. By this method the contaminated surface sand in the filters will be cleansed and stored to be used again as required.

One of the most interesting things to be seen at the filtration plant is the sand washing plant. From a large dredge operating in the lagoons which intersect the island the crude material is delivered through pipes to a gradually widening table, which has the effect of reducing the velocity of flow from the pipe. The coarser gravel settles through an opening and is carried to a screen by a drag operated by an endless chain. The remaining material passes into a large "V" shaped box, the dirt and the finer sand flowing over the top with the surplus water. The heavier sand and fine gravel upon settling to the bottom of the box is delivered through spigot pipes to a washer box, at the bottom of which water pressure is applied and the remaining fine material removed. The sand is then elevated by bucket conveyor to the storage bin and from there by cars to the filters.

It should be remarked that in order to have dry ground to work on in putting in the foundations it was necessary to dig a drainage canal 4,000 feet long around the site, which involved the removal of 45,000 cubic yards of material, and in the same to establish a central pumping plant to keep the water in the canal low enough to permit of the above. The minimum depth of the canal is about 9 feet below average high water. By this method satisfactory results have been obtained, approximately 3,000,000 gallons of water having to be pumped each day during the period of ordinary high water.

When this filtration plant is completed the roofs will be covered with earth and sodded, the idea being to use this space as part of a large public park, the island being the favorite resort for picnics and outings for the citizens. The only indications there will then be of the filters will be the tops of the projecting manholes and the various concrete buildings. The office building has been erected entirely of concrete and is two stories high with basement. By rubbing and finishing the walls of this building with carborundum brick a finish not unlike white marble has been made possible, and with a roof covered with French A red roofing tile the entire exterior has been made very artistic.

It is anticipated that the work will be entirely completed before the end of October and the delays to date have all been caused by the difficulty in securing the laborers to live on the island. When finished the Toronto filtration plant will undoubtedly be worth investigation by municipalities contemplating the construction of filtration systems.

Problems of Road Construction.

By W. W. Crosby, Chief Engineer of State Roads Commission, Baltimore, Md.

THE speaker conceives it to be best to confine his remarks to details of actual work out on the job itself.

Generally speaking, the first operations are those of grading and installing the underground structures, such as culverts, abutments for bridges, and underdrains.

If any clearing or removing of trees and old stumps is to be done, it should be done promptly and thoroughly. Where practicable, the removal of trees should be accomplished by cutting off the roots around the tree a little distance away from the trunk and pulling the tree over so as to rip out the stump proper. The roots thus left in the ground will do no serious harm unless within a foot of the road surface. It is sometimes the practice of the speaker to allow trees to be cut off close to the ground and the stump to remain, provided that there is to be not less than two feet of new fill between the top of the stump and the bottom of the surfacing. It may be trite but it is at least safe to remark that in no case should a foreign stump be allowed to be placed in any embankment.

Underground structures should almost always be started as early in the proceedings as practicable, especially those which cross the road. Such procedure not only insures their being out of the way of the later work and gives more opportunity to conveniently handle the public traffic generally to be provided for over a road, but also allows more careful construction and better results in the backfill. Only

too often serious defects and extra expense occur in the surfacing over culverts too recently installed before the advent of the surface over them. In this connection the speaker will state that it is his practice to use vitrified clap pipe for all culverts from twelve to twenty-four inches in diameter where the covering over them is not less than two feet in depth and concrete boxes or cast iron pipe where the "head room" or cover is less. He has experimented in a very few instances with corrugated wrought iron culvert pipes, but is as yet unconvinced of their general desirability. In his experience, he has had no difficulties with the use of first-class vitrified clay pipe even under heavy fills of, say, twenty feet or more. Above 24-inch, the speaker prefers what is called "double strength" if clay pipe is to be used, but generally concrete boxes would be cheaper. Of course, in the use of clay pipe, care must be had in the laying and backfilling, especially to prevent the presence of anything like a stone nearer the pipe than, say, one foot. The speaker has seen a stone about the size of one's two fists forced by the fill above directly through the wall of an 18-inch clay pipe.

The bed on which a pipe culvert is to rest is a consideration frequently slighted. Only too often is it allowed to be of improper or of uneven character. This is of especial importance where short length joints of pipe are used. A bed of sand or fine gravel on which to lay the pipe is often desirable and advantageous. Even oyster shells or crusher screenings may be used. The speaker had one case ten years ago where a road crossed a bight of salt marsh by a pile-trestle about two hundred feet long. It was proposed to fill in the space instead of making the necessary renewal of the old wood work and to care for a small stream crossing the road through the marsh by means of a double line of 30-inch cast iron pipe. The surface of the marsh was at about mean high tide and the marsh mud of unknown depth. Therefore, along the slight stream depression through the marsh, the speaker laid a bed of oyster shells, the cheapest available mineral material, about ten feet longer than the pipe and about twelve feet in width. The shells were dumped from carts through the floor of the old bridge and spread out as necessary to probably an average depth of two feet and with their upper surface level and just above high tide. The pipes were then laid on the center of this bed and the filling over them was placed. The results have been entirely satisfactory.

Especial attention to drainage is necessary in Maryland work owing to both the prevalence of loamy or clayey soils and to the "open" character of the winters. A great deal of "French drain" is used. The pipe is vitrified clay and generally 4-inch, sometimes 6, in diameter with bell and socket joints. Stone, gravel or shells may be used for backfilling with apparently equal results. We think it preferable to install the underdrain just ahead of the surfacing work in most cases.

Practically all pipe ends should be protected by masonry head walls as a matter of protection and economy, to say nothing of appearance. Generally, our masonry in concrete, a "one-three-six" mixture, and on designs made in our own office. Flat slabs or girders, reinforced when necessary by twisted or corrugated steel rods, are usually sufficient. Occasionally, special circumstances warrant an unusual design. In such a case, bidders are given the opportunity to submit their offers with their own designs. These latter are checked by our office and the comparison is made between the offer and the office plans and estimates so that a decision may be made.

Of course the key to successful bridge work is in a proper foundation, and this is a subject by itself. Not much more can be said here than that almost all kinds of foundations have their place and the real problem is one of proper selection in each case.

Preliminary to the placing of the surfacing comes the preparation of the roadway for it, or what is generally known as "subgrading." The speaker considers the matter of a proper sub-grade one of the most important of all construction problems, and regrets to be obliged to state that it seems to be one too often neglected. In his judgment, more failures in the surfacing have had their rise in defects of the sub-grade than in any other source. In fact, the importance of a proper subgrade can hardly be over-estimated. A proper sub-grade should be firm, even and as little susceptible to damage by water as possible. Gravel, preferably sandy or with no excess of clay, gives an ideal subgrade when properly shaped and rolled. Clean sand will furnish a most satisfactory one, though it may bring about some waste surfacing material. In many localities, neither sand nor gravel is available. Crusher screenings may be substituted with very satisfactory results. Some clays will make a very good sub-grade, if not too wet so as to be muddy or rubbery, nor too dry so as to be dusty, provided the surfacing and under-drainage are so installed as to keep the clay in its good condition. Other clays cannot be thus handled. The speaker has secured satisfactory results in some instances by the use of a layer of gravel, sand or screenings from three to six inches thick immediately below the surfacing. Also rolling a layer of stone

into the sub-grade after shaping it—but before applying the first course of the regular surfacing, frequently relieves the defect of the sub-grade. Another way is to prepare the sub-grade by shaping and rolling as usual and then to apply a first course of the macadam of special composition. That is, instead of using for this course, one size of stone, to mix with the ordinary No. 1's, say, 50 per cent of sand or screenings (for instance by running the screenings and No. 1's together from the screen). Then spread this mixture on the prepared sub-grade, harrow it, and then roll. This has proved a very satisfactory solution in many cases where otherwise the failure of ordinary 8-inch macadam was almost certain. Probably the fine material in the No. 1's prevented the coming up of the sub-grade material into the macadam and thus its destruction in freezing and thawing wet weather.

In passing the speaker wishes to state that he considers this matter of sub-grade is only too often neglected in city work where a concrete base is to be used under the surfacing proper. Too much dependence apparently is placed on this conconcrete base in many cases and even unnecessary expense is had for such concrete when by proper attention to the sub-grade beneath it not only would better results, but also much saving in cost, be had.

In the reconstruction of old roads it frequently happens that but slight changes of grade are desirable. Many of these old roads, such as the "pikes," have been "stoned" in the past and so massively, but withal so crudely, that they now present to travel surfaces that are solid beds of stone (mostly large), whose unevenness and roughness furnish the main, if not the only, reason for their treatment. Many of the audience will recognize readily a statement from the speaker to the effect that those familiar with such an old road are hostile to any idea of digging into or removing, if only for the purpose of breaking up the large stone, the old roadbed. Nevertheless such a procedure is often the economical thing to do. If it can not be done for any reason and the old stone bed must be allowed to remain, then the grades for the finished surface must be properly adjusted so as to provide at least a minimum thickness of new surfacing on top of the high points of the old stone, and this minimum cannot successfully be less than four inches in the case of water-bound macadam. With proper care in bituminous work it can probably be reduced to two inches, and possibly in some cases even less.

Further, in such work, on an old road, the depressions to be removed furnish a problem. It will not do to fill them with an absorbent material like clay or loam, and filling them with surfacing stone may be necessary even if expensive. Frequently, however, a cheaper roadside stone of inferior quality will answer. The same remarks apply to thin layers of material to come between the old road bed and the bottom of the new surfacing.

In what may seem perhaps to have been a rather cursory way the speaker has at last reached the problems of surfacing. And here, perhaps, a breadth should be taken in view of the vast outlook.

Is there anything but "problems" in the subject of surfacing? And what a wide field of them offers, which yearly is becoming wider and more diversified, thanks to the activity of the proverbial American ingenuity. To discuss, or even to review, a list of all the problems in this field would be beyond the bounds of the present conditions, so the speaker will, in closing, merely mention a few salient points under the various kinds of surfacing on which he has convictions, or to which he feels it might be proper to direct your attention.

With sand-clay surfaces it is important to get an intimate, even and properly proportioned mixture of the sand and clay.

With unscreened gravel surfaces it is necessary that the gravel be free from stones larger than, say, a goose egg, and from an excess of fine material, i. e., either sand or clay. It must have, however, sufficient "fines" to fill the voids of the gravel stones, and preferably these "fines" sould be of a highly cementitious character. If too weak in cementing qualities naturally then something, such as pitch, must be added to make up for the lack of bond among the round gravel stones and thus to remedy their tendency toward displacement under traffic, especially in very wet and very dry weathers.

With screened gravel surfaces, when the correction of the sizing is had by the screens, the same remarks then apply. In some cases screened gravel may be satisfactorily "bound" with limestone screenings. With marl surfacing the problem is to secure the necessary uniformity of the material and then to properly compact it in place. Plentiful watering and rolling are important.

With broken stone macadam, in the experience of the speaker, the most necessary and at the same time the most difficult thing to obtain apparently is the proper compagation or interlocking of the broken stone. Almost always the rolling of the different courses is less than it should be for the best results, and the deficiencies in rolling are attempted to be made up for by using the screenings too soon and too profusely. Another problem is the securing of the utmost degree of

uniformity in the macadam layer as to thickness, evenness and homogeneity—no irregular depths of stone, no irregular thickness of courses, no pockets of material greatly varying in size, etc.

And with all these just mentioned surfaces, the speaker, at the risk of repeating, must again call attention to the problem of getting proper rolling or composition.

With bituminous surfaces the main problem is perhaps again the securing of uniformity. Practically all defects may be traced to the lack of it. The use of mechanical appliances of course always helps in securing regularity and homogeneity and generally tends to economy as well. Their desirability is beyond question.

With pavements of various kinds perhaps a general statement might be made that one important problem is to get them as dense as possible, that is, with sheet pavements, such as asphalt, bitulithic, concrete, etc., the mineral portion must be so proportioned that the voids will be at a minimum and the cement must then fill the voids. The other necessities of homogeneity, or uniformity and compactness, also apply. With block pavements the joints must reach a minimum and then be properly filled. The blocks themselves need uniformity and their placing must be evenly and solidly secured.

The speaker trusts he may have given an idea of the problems to be encountered in construction, if not a solution for all of them. In solving them, one and all, no factors will count more than carefulness and experienced intelligence.

Equipment of Electric Lighting Stations for Small Towns.

By Carl D. Hoskins, Manager of Electric Lighting Department, General Electric Co., Schenectady, N. Y.

IT is not possible in an article of this size to enter into any detailed description of all the apparatus required in an installation. A full description, however, may be readily obtained from the catalogues and descriptive matter published the electric manufacturcompanies upon the necessary electrical apparatus, and from numerous builders of well recognized and excellent engines and boilers.

The building should be constructed of the material which is most readily obtainable, with due consideration being given to the items of insurance and maintenance. It is often true that the cheapest first cost does not mean the cheapest building when these items are taken into account.

For this size of installation, general practice seems to have determined that fire tube boilers are the most satisfactory; they represent a smaller first cost than the water tube boiler and, in these sizes, gixe approximately the same economy.

ENGINES.

As a general proposition, it does not pay to install condensing apparatus in installations of less than 200 kw., and for this reason our plans have been based upon non-condensing equipments. This, however, is largely dependent on local conditions, and in localities where condensing water may be readily obtained, and where fuel costs are comparatively high, it may often be shown that the best economy is obtained by the installation of a condensing outfit.

The question of reducing the first cost of an installation has also led to the recommendation of belted units, and while this introduces the inconvenience always attendant upon the use of belts, it is believed that this inconvenience is more than offset by the difference in cost between belted and direct connected units of this capacity.

GENERATORS.

The generators recommended for these plants are built for belt connection to the engine and are of the alternating current type. They are designated as three-phase revolving field machines, and are capable of delivering 25 per cent. more than their rated load for three hours without injurious heating.

An alternating current machine is recommended rather than direct current; it has all the advantages which can be found in direct current apparatus, and, in addition, allows the use of higher pressure or voltage, thus greatly diminishing the cost of line material and making it possible to carry current to a much greater distance than can be done with a direct current machine. Each generator is provided with an exciter which is itself a small direct current generator.

It may be well at this point to call attention to the fact in this day and generation, with the possibility of power steadily and rapidly developing, that no consid-

eration should be given to single-phase generating machinery, as this is entirely unsuited to power work. There is no objection whatsoever to operating three-phase machines single-phase for lighting service, but the future should never be lost sight of in providing a generating equipment for the present.

SWITCHBOARD.

The switchboard of an electrical generating station has as its primary function the same purpose as the switchyard of a railroad system: On each main track, or bus of the switchboard, are delivered the units of electrical energy from the generators, and these units are distributed through the system of wiring for lights and motors, by means of the controlling switches located upon this board. The switchboard, then, is the keynote of the station, and it is particularly important that it be provided, not only with switches, but instruments which will show at all times the condition of the circuits, and with protective devices which will guarantee the greatest degree of safety. This is an item upon which it does not pay to economize too closely.

TRANSFORMERS.

Where current is generated and distributed at 2300 volts, it is necessary to have transformers in order to reduce this voltage low enough to be conveniently and safely carried into the buildings.

These transformers consist of two windings around an iron core. The inner or primary winding consists of a large number of turns of comparatively fine wire connected to the high voltage lines from the power house. The secondary, or outer winding, consists of comparatively few turns of larger wire from which the wiring into the buildings is taken. These windings are thoroughly separated from each other and from the iron core, by a suitable insulating material.

The structure thus described is placed in an iron tank and the tank filled with oil, which latter serves the double purpose of increasing the insulation and dissipating the heat resulting from the losses in the transformer. They are known as 60-cycle single-phase core type transformers. Their primaries are wound for 2080 volts and their secondaries for 110 and 220. In use, they are usually fastened on the poles.

For street lighting it is necessary to use a specially designed transformer, so constructed that it will give a constant current. It is constructed in the same general manner as the constant potential pole type transformers above described, except the secondary coils are so arranged with respect to the primary coils that they adjust themselves automatically to maintain a constant current on a lamp circuit; this is done by an arrangement of counterweights.

Street lighting is done by means of both incandescent and arc lamps in series on the same circuit. The receptacles in which these lamps are held are so arranged that if one lamp burns out, or for any reason breaks, the others will continue to burn without injury and without difference in their light.

The street lamps may be supported by a bracket or they may be suspended in the middle of the street by wires between two poles. The method of suspension and the position of the lamps depend entirely upon the character of the foliage along the street. If the bracket method is used, it is generally found most advisable to place lamps on both sides of the street; that is, first on the right side and then on the left.

The incandescent lamps recommended for this purpose are what are known as the tungsten series lamps. These have a very low power consumption and give a brilliant white light. Each lamp is provided with a shade of sheet iron or copper so designed that it distributes the light up and down the street.

METERS.

In each building where current is used a recording wattmeter should be installed. This instrument accurately records all current which is used and may be read at intervals, and the customer charged for exactly the amount which he has consumed.

The use of meters is highly recommended instead of what is known as the flat rate system, as they not only guarantee that the consumer pays for exactly what he gets, but also insure the company against the abuse which is so common under the flat rate system.

The first investment in meters is small sompared with the saving which they effect in the output of the plant.

BUSINESS MANAGEMENT.

As in any other enterprise, the success of a power plant depends largely on the progressiveness of the business management. The operation of the plant requires only the ordinary care and intelligence given to any steam engine equipment. The electrical end is far simpler than is ofttime imagined.

To the management falls the task of educating their public up to the uses of electricity, of obtaining customers and of keeping them satisfied.

The purposes for which current may be used may be divided into three classes: commercial lighting, street lighting, and power. Each class should be carefully investigated and developed.

COMMERCIAL LIGHTING.

This portion of the load demands the first and most careful attention on the part of the management. There is no question but that many people recognize the perfectly evident and obvious advantages of electricity, and are only deterred from using it by the fact that the first cost of wiring their premises is a larger outlay than they feel they can afford.

To meet this view, many managements have undertaken to wire buildings, charge only the actual cost of labor and material, plus a reasonable interest, and spread the payments for so doing over a period of from three to twelve months, so that at no time is it a burden to the customer.

The cost of wiring amounts to approximately $1.50 per outlet when visible or knob and tube wiring, as it is called, is used. If concealed wiring is desired, the cost amounts to somewhere around $4.50 or $5.00 per outlet. Even if the power company itself does not care to undertake the wiring business, it is not at all unusual for a small supply and construction company to be formed, often by the same men who are interested in the power plant, which pushes this work in close co-operation with the central station.

In the early days of incandescent electric lighting, it was found that considerable trouble and dissatisfaction arose among customers from using poorly made low efficiency and improperly rated lamps, and still further by continuing lamps in service long after they had become blackened, dimmed and useless.

As a satisfied customer is the best possible advertisement, central station managers found it necessary to advise and assist their customers in the selection and proper use of lamps, and, as the price became lower, the free renewal of lamps was adopted as the simplest and most effective method of insuring satisfactory service.

All new carbon lamps, manufactured by companies of established reputation, now maintain their efficiency within reasonable limits throughout life, hence it is not as essential as formerly for a central station to supply free renewals to insure satisfactory service. Furthermore, the new, improved high efficiency lamps, such as tungsten, are too high in first cost for free renewals, and as these lamps will supplant carbon lamps to a very large extent, it would appear that the future tendency will be more and more toward a customer paying for his renewals.

The marked improvement in the art of lamp manufacture in the past two years has resulted in a great advance in the incandescent lighting branch of central station service. Where, as formerly, for the ordinary incandescent lamp, it required from 3.1 to 3.5 watts energy for each candle light; we have now

The Gem, or improved carbon lamp, consuming only 2½ watts per candle of light,

The Tantalum lamp consuming only 2 watts per candle of light,

The Tungsten lamp consuming 1¼ watts per candle of light.

For a considerable portion of the central station service, the cheapest as well as the best lighting can be obtained only by using tungsten lamps. This lamp maintains its initial candle-power practically unchanged throughout its life, and has a color value closely approximating that of direct sunlight.

The average life of the tungsten lamp properly installed is over 800 hours. While the high cost, as compared with carbon, together with a certain percentage of accidental breakage and early burn-out may retard its rapid introduction, consumers can in time be educated to appreciate the fact that the average result they obtain will, at a given cost for current, make tungsten lighting the cheapest as well as the best. Many central stations have assisted in the introduction of tungsten lamps, thus greatly improving their service, by furnishing these lamps on a rental basis for each lamp installed of from 20 to 35 cents per month, additional to the regular meter charge for current supplied.

The most satisfactory and efficient lighting service can only be obtained by continuous education of consumers as to the best and most economical lamps for the various conditions of their service and the best method of installation from an illuminating engineering standpoint.

The following table is interesting as it shows the relation between first cost and cost of burning, and it will be noted that as the cost of lamp increases, the amount of power (*i.e.*, watts)) necessary to produce the light, decreases, and hence the cost of burning per hour decreases in direct proportion.

Type	C. P.	Watts	Price	Cost of burning lamp per hour, with current at 15c kw. hr.
Carbon	16	56	$0.20	.0085
Carbon	32	112	.30	.017
Gem	20	50	.25	.0078
Gem	40	80	.35	.0125
Tantalum	12.5	25	.50	.0038
Tantalum	20	40	.50	.0062
Tungsten	32	40	1.50	.0062
Tungsten	48	60	1.75	.0093
Tungsten	80	100	2.00	.015

STREET LIGHTING.

This branch of the service is a steady and sure source of revenue for any lighting company. It is a matter upon which

there should always be the closest cooperation between the lighting company and the board of aldermen or trustees, and they should work in harmony to determine what system will give the most efficient and satisfactory results.

Of late years there has been a great deal of investigation in connection with street lighting systems. The general consensus of opinion is that in business streets, or in localities where there is no foliage, arc lamps should be used. They may be hung fairly high, and as there is no obstruction, the light is diffused or spread up and down the street as far as its beams will carry; giving a brilliant illumination, not only upon the streets themselves, but upon the walls of buildings where it is just as essential.

In the shaded streets of the residential sections, a brilliant illumination is neither necessary or pleasant. Furthermore, the shade trees prevent the high hanging of lamps and the proper diffusion of the light up and down the streets. For this reason, incandescent lamps of 40 or 60 candlepower, placed at frequent intervals, give a much more uniform and satisfactory distribution of the illumination.

The arc light in such streets produces areas of intense light surrounded by unlit areas which appear all the darker in comparison. It must be remembered that incandescent street lamps can be operated for about one-quarter the cost of an arc lamp, therefore, many more may be had for the same money outlay.

The rates charged for street lighting are well established in different sections of the country, varying slightly with the price of fuel, and every attempt should be made to secure a long term contract for this service.

The Relation of Technical Men to City Planning.

THAT engineers have not contributed their proper share as citizens, to civic betterment movements, has been more than once asserted. The special qualifications of technical men for such work, however, were presented with some emphasis in a recent address before the Electric Club of Chicago, by Wm. B. Jackson, of the firm of D. C. and Wm. B. Jackson, Chicago and Boston. Mr. Jackson calls attention to the fact that the engineer, by the demands of his profession, is continually called upon to exercise just those qualities of foresight and attention to both technical, sanitary and moral factors in business that are so much needed in all effective city planning.

In manufacturing establishments, says Mr. Jackson, much attention is given to perfecting the most efficient arrangement of avenues of intercommunication and for the progress of material in the process of manufacture, and careful attention is given to obtain processes that will fit in with the requirements of the future as well as fulfill the needs of the present. An electric power plant built to fulfill the requirements of today, without careful consideration of its ability to appropriately expand to fulfill the requirements of the future is unhesitatingly classed as a blunder; yet we must admit that just this situation exists in our cities, and that on the whole our engineers and other technical men have not taken an active part in correcting the error.

When we leave the consideration of manufacturing establishments, we are prone to forget the lesson that has been learned there as the result of much experience, and we fail to apply the lesson to the wider problem of the cities. We are inclined to rest content with our cities as they may happen to grow, with very little thought of any general plan; whereby the avenues for traffic will be arranged to give effective intercommunication between all parts of the city itself and between the parts of the city and the outside regions; whereby the public utilities will be arranged to give the most economical and suitable service; whereby plenty of light, air and cleanliness will be made an essential part of the city; and whereby an attractive city will be assured.

Properly laid out highways are as necessary to the efficient operations of a city as are properly planned and executed avenues for the progress of materials which are being worked up in a manufacturing establishment.

We recognize the necessity of having good air and light with cleanly conditions if we expect to obtain the most effective work from employees in a manufacturing establishment, but how much do we on the whole recognize this principle when we consider the general business community and the homes of the masses in our cities? It is without doubt that there would be obtained a relatively greater increase in the usefulness of the people of a great city by providing the masses with plenty of light and fresh air to grow up with and live in, than by providing plenty of light and fresh air during work periods only.

We have a tendency to pass by the matter of an attractive city or the "city beau-

tiful" as something for the consideration of architects, landscape gardeners and artists alone, but this is a mistake. We are all working for better and more efficient men and women. Our points of view may be different, but we should all be striving for a common end. Can any one really believe that men and women living in squalid quarters can be so broadly effective as they would be if living in harmonious attractive quarters? The same situation exists here as in the electric light plant. The morale of the people is raised by attractive surroundings.

Taking into consideration the tendency of the time, it does not seem to be quixotic to believe that the day is not very remote when an ugly spot in a city will be considered as a public nuisance in much the same way as an unpleasant odor is so considered today. It is likely that artistically inharmonious surroundings have a more far-reaching effect upon the character of our citizens than the presence of unpleasant non-pestilential odors. It is only because cities do not feel the same keen competition to which manufacturing concerns are subjected that it is possible for them to survive under the conditions imposed by lack of appropriate plans, but that does not lessen the economic loss occasioned by such lack.

We must of necessity come to the conclusion that a city cannot grow to its most perfect stature without an officially accepted plan having the hearty support of the people, since we cannot have a most effective city unless it is laid out in accordance with such a plan, nor is it possible to otherwise properly provide for its growth. We are all aware that a large electric light or telephone company cannot thrive at its best unless it is able to expand with the guidance of a well-thought-out plan. Then why should we expect the greatest corporation of them all to rise to its best without such a plan having the earnest backing of every thoughtful citizen? City planning is a subject well worthy of the earnest thought of our broadest citizens, amongst whom are the technical men.

That the larger municipalities, at least, are awakened to the value of city planning is evidenced by the following list, and, as will be noted, the technical men are prominent in the list of those interested.

The following is a list of towns and cities engaged in city planning, with an engineer or city planning expert in charge:

CITY.

Altus, Okla.—L. P. Jensen.
Atlantic City, N. J.
Baltimore, Md.—Olmsted Bros.
Boston, Mass.—Society of Architects.
Buffalo, N. Y.—George Cary, 164 Delaware avenue, Buffalo.
Chicago, Ill.—Daniel H. Burnham.
Cleveland, Ohio—Daniel H. Burnham, Arnold W. Brunner, 33 Union Square, W., New York.
Colorado Springs, Colo.—C. M. Robinson.
Columbia, S. C.—Kelsey & Guild.
Columbus, Ohio.
Denver, Colo.—C. M. Robinson.
Detroit, Mich.—C. M. Robinson, F. L. Olmsted.
Gary, Ind.
Glen Ridge, N. J.—John Nolen.
Grand Rapids, Mich.
Greenville, S. C.—Kelsey & Guild.
Harrisburg, Pa.—Warren H. Manning, 101 Tremont building, Boston.
Hartford, Conn.—F. L. Ford.
Indianapolis, Ind. — Charles Carroll Brown, Dr. F. B. Wynn.
Jamestown, N. Y.—C. M. Robinson.
Janesville, Wis.—Dr. C. C. Dwight.
Jersey City, N. J.
Kansas City, Mo.—Geo. E. Kessler.
LaCrosse, Wis.—John Nolen.
Los Angeles, Cal.—C. M. Robinson.
Louisville, Ky.—F. L. Olmsted, Jr.
Madison, Wis.—John Nolen, Harvard Square, Cambridge, Mass.
Memphis, Tenn.—George E. Kessler, 523 Frisco building, St. Louis.
Milwaukee, Wis.—John Nolen.
Minneapolis, Minn.—Warren H. Manning.
Montclair, N. J.—John Nolen.
Newark, N. J.—John Cotton Dana.
New Haven, Conn.—Olmsted Bros.
New Orleans, La.
New York City—Harold A. Caparn, Water Park, Jamaica Bay.
Oakland, Cal.—C. M. Robinson.
Omaha, Neb.
Philadelphia, Pa.—Albert Kelsey.
Pittsburg, Pa.
Portland, Me.—Olmsted Bros.
Portland, Ore.—Olmsted Bros.
Providence, R. I.
Reading, Pa.—John Nolen.
Ridgefield, N. J.—C. M. Robinson.
Roanoke, Va.—John Nolen.
St. Louis, Mo.—George E. Kessler.
St. Paul, Minn.
San Diego, Cal.—John Nolen.
San Francisco, Cal.—Daniel H. Burnham.
Savannah, Ga.—John Nolen.
Scranton, Pa.—John Nolen.
Seattle, Wash.—John C. Olmsted.
Springfield, Mass.
Staten Island, N. Y.
Walla Walla, Wash.—John C. Olmsted.
Washington, D. C.—F. L. Olmsted, Daniel H. Burnham, Charles F. McKim, Augustus St. Gaudens.
Watertown, N. Y.—C. M. Robinson.

EDITORIAL · COMMENT

The Effect of Public Service Commissions Upon Securities of Companies Operating Thereunder.
Investigation of Austin Dam Failure Needed.

THE EFFECT OF PUBLIC SERVICE COMMISSIONS UPON SECURITIES OF COMPANIES OPERATING THEREUNDER.

This subject was discussed at some length in this department of MUNICIPAL ENGINEERING in vol. xl, p. 425, and the general conclusion reached was that in general the effect of the control of public service corporations by a central state expert body would be beneficial. Some corroboration of this position is found in an address of James G. Cannon, president of the Fourth National Bank of New York, before the recent convention of the American Electric Railway Association. He shows the difficulties arising from limited terms of franchises and from fixed rates of fare having no direct relation to the cost of the service. He also considers the exploitation of urban and interurban lines on the one hand and the necessary expansions on the other as factors affecting capitalization and dividends thereon; the fluctuations in prices at which stocks can be sold in the market on account of changes in management, distrust of the management by prospective investors, often without reason, and the uncertainty of the bond market for any but the strongest companies. He includes in his conclusions the following significant paragraphs:

I believe the answer to most of the problems which at present confront electric railways will come largely through the workings of the public service commissions, if these bodies are wisely appointed and perform their functions in an equitable manner.

Unquestionably the personnel of these commissions has yet much of a practical nature to learn from the management of railways but if the commissions and the railroads will work in harmony with a singleness of purpose for the welfare of the traveling and investing public, in my judgment we may soon look for a marked improvement in every feature surrounding the traction situation.

If in the past electric railway securities have not been considered a prime investment, the managers of traction corporations have themselves largely to blame.

In the last number of *Public Service*, a magazine which is at all times a consistent supporter of the public service corporations, even to the extent of misrepresenting the operation of municipal public service plants, quotes approvingly the arguments of the Newark *News* in support of the New Jersey Public Utilities Commission, prefacing its extracts from those arguments with these words:

New Jersey politicians are agitating for abolishment of the New Jersey Public Utilities Commission, which was recently organized in that State. The claim is made that the expense of the commission is a burden upon the taxpayers, but those who have followed the workings of the commission declare that the politicians are opposing state regulation because it has deprived them of the power to deal in their own manner with the public utility corporations in their respective localities.

There is no question that the opposition to the commission form of regulation is strong and that there will be a fight in the next legislature to either repeal the law that created the commission or modify it to such an extent that the body will have but little power. Many of the newspapers of the State are upholding the commission and point to the work it has accomplished to better conditions, even during the short time it has been in operation.

Regulation by commission in New Jersey, however, is in its infancy. An insufficient law gave a commission limited powers for ten months, and then the present stringent act went into effect only five

months ago. In spite of these limitations, much has been undertaken by the commission in the year and a quarter of its existence. Most important questions are now before the commissioners for their determination.

Among the deeds of the commission which are approvingly quoted from the *News* are the following:

It has established a rule that limited franchise grants should provide for safeguarding the public interest in continuous and uninterrupted service at and after the expiration of the term of the grant, and shonld require the maintenance of the property in good order throughout the full term of the grant. This means that the commission will refuse to approve a franchise that does not provide for a continuance of good service to the public during the term of the franchise and after the termination of the grant.

It has made an order that corporations receiving a certificate of approval for issuing securities must make half-year reports of the amount of stock or securities issued, sold and delivered, and the extent to and the purposes for which the proceeds have been disbursed. This is a safeguard against stock-watering in the future. It has compelled one corporation to cease evading the purposes of the law in the issuing of bonds.

It has prevented competition with a regulated monopoly (a gas company) by refusing to approve of a franchise granted by Shrewsbury township, Monmouth county, to a rival corporation. The refusal was based on the sound ground that the field was a proper one for a natural monopoly (regulated), and competition would be ultimately wasteful and expensive.

It has forced a telephone company to give adequate service upon demand.

It has held that the existing passenger rates between Arlington and Jersey City are fair because of lack of competition.

It has brought about a reduction of Pullman rates to shore points.

It has compelled compliance—temporarily, at least—with the trolley transfer obligations imposed bf the terms of Newark ordinances.

It has forced a substantial reduction of rates for gas and electricity in a number of communities served by the Consolidated Gas Company of Long Branch.

It is hardly possible that men so intimately acquainted with the side of the case on which the public service corporations are ranged would approve of the State utilities commissions in this emphatic way if they were not of opinion that the condition of their companies would be better under competent and efficient regulation than under present conditions.

Attention is called also to the extract from the *Review of Reviews* quoted in the Question Department.

Even the partial control of rates and conditions of street railway operation by the city of Cleveland under provisions which give some approach to the same requirement of fair treatment has protected the stock of that company, according to the statements of Cleveland financiers, so that it is now called a "gilt edge investment security" and "is bound to become the leading investment stock of Ohio and the price has risen from par to 4 or 5 points above par since the people of Cleveland voted to accept the ordinance.

INVESTIGATION OF AUSTIN DAM FAILURE NEEDED.

There have been so many differences in the opinions of experts who have examined the ruins of the dam at Austin, Pa., and there are so many questions of the utmost importance to engineers raised by the discussions of the matter that it seems desirable that a most thorough and disinterested examination of the structure and of the other facts in the case be made before the elements have removed any material part of the evidence. Most properly this investigation would be made by the State of Pennsylvania, but if this cannot be brought about promptly, some association, such as the American Society of Civil Engineers, which has money enough at command to pay the possibly large expense should take it up.

The earlier evidence in the case indicated that the failure was due to slippage of the dam on its base or of one stratum of the base on another, with subsequent erroneous treatment of the case and a later slippage which caused the disaster. This is the opinion expressed by Prof. F. P. McKibben, an expert for the district attorney at the coroner's inquest, who presents evidence to the effect both as to actual occurrences

at the time of the failure, and, in his opinion, errors in design, since the base was merely level and not stepped and was not carried deep enough to prevent sliding or percolation of water under the dam, also errors in construction, since large smooth joints passed horizontally through the dam, due to lait ance.

Walter H. Sawyer, consulting engineer, Lewiston, Me., reports in *Engineering Record* the results of his independent investigations for his own purposes. He does not accept the theory that any part of the ledge on which the dam rested moved down stream and attributes the entire movement to sliding of portions of the dam on other portions at the horizontal joints produced by the laitance at planes between deposits of concrete in the construction.

Alfred D. Flinn, of the New York Board of Water Supply, in his evidence before the coroner follows more in detail the line of Prof. McKibben but shows some of the difficulties attending the examination and some of the evidence which could not be obtained with the means of examination at hand. Mr. Sawyer also recognizes the fact that not all the evidence is readily visible and he recommends the detailed investigation with sufficient funds to make it complete. MUNICIPAL ENGINEERING wishes to add its vote to this proposal and trusts that the duty will be accepted by some organization, preferably the State with the American Society of Civil Engineers as second choice.

THE QUESTION DEPARTMENT

Who Should be Assessed for Sidewalk Within Street Intersection Area?

There is a question in this city who is to pay for the corner of sidewalk and curb as per enclosed diagram.

J. U., Port Washington, Wis.

The diagram asks who must pay for the rectangle of sidewalk at a street corner which does not abut on the lot but corners on it. This question is quite fully discussed in MUNICIPAL ENGINEERING, vol. xxvi, p. 25, as to sidewalks, and in vol. xxxviii, p. 110, as to street intersections. Other articles having some bearing on the case will be found in vol. xxviii, p. 102; vol. xxiv, pp. 369 and 384; vol. xxii, p. 21; vol. xvi, p. 398.

The question is one which should be referred to the city attorney, who is presumably familiar with the statutes of the state. In some states he sidewalks are considered to be the property of the owners of the abutting property, while in others, the sidewalk is a part of the area of the highway and the cost of improvement is assessed in the same way as that of improving the street driveway. In such cases the assessment for the intersection may be spread over the property on the block or may be paid by the city as the law and the custom in the city determine.

Street Grades in Small Cities.

This city has under consideration the passing of an ordinance regulating street sections and grades for curb and gutter. Quite a good deal of cement curb and gutter has been built this season. Much more is now being contemplated. The grades of our streets vary from zero to ten per cent. None of our streets are paved. Sidewalks are being built to grades which were established some thirteen years ago. In fixing these grades at street corners no general rule seems to have been followed other than by taking levels at the natural surface or on the old tar walks and calling that "grade." Hence it is impossible in many cases to give a grade for curbing that will shed the water toward the street and I have so far been unable to find any general rule for giving such grades that will fit even the majority of our street crossings. The standard texts on roads and pavements give plenty of information regarding street sections where the grades are or can be made theoretically correct, but the fellow is left in darkness who is trying to get the best results out of the existing conditions in an old town.

Any information you can give us along the lines above mentioned will be appreciated.

L. ———, Ill.

This question is one which is theoretically easy but practically any general system must be modified to suit local conditions. Articles in recent numbers of MUNICIPAL ENGINEERING which have a bearing on the subject are as follows:

In vol. xli (current): "Drainage for Flat Streets," p. 46; "Breaking Grades of Streets on Hills," p. 47; "The Right to Change Street Grades for Public Necessity," p. 55.

In vol. xl: "Form of Grade Book for Small City," p. 210; "Street and Sewer Designs for New City," p. 43.

In vol. xxxix: "Damages and Benefits for Changing Street Grades," pp. 216, 217; "Sidewalk and Curb Grades," p. 354, which goes into considerable detail as to methods of treating various special cases.

In vol. xxxviii: "The Care of Surface Water at Street Intersections," p. 11.

In vol. xxxvii: "Damages for Change of Grade," p. 117; "Establishing Grades for Streets, Sidewalks and Curbs," pp. 181 and 256, giving references to other articles on the subjects in previous volumes; "Some Examples of Street Design," p. 307; "Ordinances Concerning Sidewalks," p. 328; "Change to Establish Grade of Street," p. 337; "Storm Drainage at Street Intersections," p. 374.

These articles discuss most of the points to be considered in working out an answer to the question, from one point of view or another. It would not be possible to make an answer directly applicable to the particular case without detailed knowledge of the special circumstances and actual inspection of the ground with this knowledge in hand.

As regards the sidewalks, there should be full information as to the legality and finality of the grades already established, the damages that may accrue from change of the established grades, the cost of reconstructing sidewalks set to these grades, the possibility of draining the sidewalks elsewhere than to the gutters.

As regards the streets, there should be information as to the width between curbs, the modern and most commendable tendency being toward narrow driveways, not to exceed thirty feet between curbs unless there is a street car or interurban line on the street. This means a wide lawn in many Illinois towns with consequent increase in necessary height of sidewalk above the gutter in order to drain water across the lawn to the gutter. Again, it is customary in grading city streets in a level country to cut the area between curbs down well below the lawns and sidewalks. This excxavation must be made to

some extent to give room for the foundation under the pavement, and can well be carried a little deeper, with material improvement in the appearance of the street as well as in facilities for drainage. When a street is perfectly level, sufficient grade can be given to the gutters to carry off water by properly excavating the subgrade so as to give the necessary fall, even if the center of the street is left nearly level. If the storm water from the street is to be taken off by sewers or underground drains with inlets at the street corners and other convenient places, the problem is easier than if the water must be carried off over the surface, for in the latter case the gutters must be high enough at the corners of the streets to allow for the proper treatment of the channels across the streets, and this makes the connections with sidewalks already laid at too low a grade more difficult, and often impossible, without relaying the sidewalks.

As to the gutters, in addition to what is said above, it is possible on wide streets to take care of them at the street corners by setting them lower than the center lines of the streets, thus making the crowns of the streets greater, which is an improvement at the intersection of two wide streets, and sometimes by running the water channels underground for short distances in the lawns and across the streets. The latter is seldom possible, however, in a town where streets are nearly level.

Enough has been said to show that it is not possible to solve such a problem by any text book methods, although they may be used to advantage in working out a proper solution. In some cases it may be necessary to reconstruct the sidewalks or even fill the abutting lots, but usually, if the property can stand the expense, which is really quite slight, it is better to excavate the roadway and set its surface low enough to take care of the drainage from the whole surface of sidewalks, lawns and roadway. This means a carefully designed system of grades for the whole town and the construction of the streets, or at least of the drainage channels, beginning at the stream which serves as the outlet, and working up the lines so that there will never be a low corner without an outlet to which water drains without hope of escape except by flooding the whole roadway.

Remedy for Overprinted BluePrints.

I note the request in the November issue of W. H. R., Kelso, Wash., asking for a remedy for burned or over-printed blueprints, and would state that a better remedy for this than that suggested is ordinary peroxide of hydrogen.

W. L. HAIN,
Warsaw, N. Y.

Explanation of Sewer Computation Diagram.

Would you please undertake to explain Mr. Geo. S. Piersons' Graphical Sewer Chart through your Question Department. Mr. Pierson gives an example but does not finish it, and I fail to grasp use or application.

M, ———, Ill.

The example given by Mr. Pierson reads as follows:

Required: The size of outfall necessary to discharge the sewage of 12,500 lineal feet of tributary lateral sewers, allowing ten persons for each lot of 25 feet front and 75 gallons per diem per capita.

The diagram is in three parts to solve the three problems presented, so arranged that the result from the first diagram is properly located to be used in the second and the second result in the third diagram.. The first part, entered with the lineal feet of sewer on the left and the number of persons tributary to 100 feet of sewer at the top, gives the tributary population on the right, the description of the example reading as follows:

Starting at the left hand column in the diagram at 12,500 lineal feet, follow the diagonal line upward and to the right to the vertical line of 80 persons per 100 feet of sewer, thence horizontally to the right across the column of Tributary Population (which is determined to be 10,000).

The second part, entered with this tributary population on the left and the gallons of sewage per diem per capita at the top, gives the total discharge in gallons per diem, and the description of the example continues, starting with the 10,000 population,—

Thence diagonally upwards and to the right to the vertical line of 75 gallons, thence horizonally to the right, when we note that the total daily discharge will be 750,000 gallons and that it will require a sewer of 15 inches diameter, 0.26 per 100 grade; 12 inches diameter, 0.75 per 100 grade; or, 10 inches diameter, 1.88 per 100 grade.

Probably our correspondent is confused because the description of the example does not continue in the same manner as for the other two diagrams.

The third diagram entered with the total gallons per diem on the left and the fall in the sewer in 100 feet at the top gives the diameter of the sewer by Latham's formula of by Kutter's formula, and the velocity of flow in the sewer, but not in exactly the same way. The description of the example in the third diagram might be continued to read as follows:

The intersection of the horizontal line for 750,000 gallons per diem and the curved black lines for diameter of sewer 15 inches is at the point of 0.26 on the scale of Fall in 100 at the top, indicating that if a 15-inch size is chosen for the sewer the fall per 100 feet must be 0.26. In like manner the intersection of the 750,000 gallon line with the 12-inch sewer curve shows a necessary fall of 0.75 per 100 and that with the 10-inch sewer line a fall of 1.88 feet per 100 feet. The fall available will determine which of these sizes of pipe must be used. If Kutters' formula is used the curve in red must be used and show heavier falls necessary for the same sizes of pipe.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited.
Give from your experience for the benefit of others.
Never mind style of composition, the fact is what is wanted.

Best Pavement for Steep Grades.

I notice an inquiry in a recent issue of MUNICIPAL ENGINEERING regarding the best pavement for steep grades. I believe your readers will be interested to know that the first bitulithic pavement laid in Boston is on Hancock street, having nine per cent. grade, the pavement having been laid in the spring of 1902, and having given excellent satisfaction, and is still in first-class condition.

Prior to the laying of bitulithic, this street was macadamized and gave a great deal of trouble, owing to the washing out of the macadam during heavy rain-falls.

JAMES H. SULLIVAN,
Division Engineer, Highway Division, Public Works Department, Boston, Mass.

Cost of Engineering on Good Roads.

Supplementing your answer to "C. E."'s

To the Editor of MUNICIPAL ENGINEERING:

Sir—Supplementing your answer to "C. E."'s inquiry as to the cost of engineering on good roads (October, 1911, p. 290), the following data, clipped from the Dallas News of February 14, 1910, may be of interest. The figures are from a table of expenditures of county road money in Dallas county, Texas.

Total expenditures up to September 5, 1909	$267,310.58
Included in this is engineering...	20,012.56
Total expenditures September 5, 1905, to January 1, 1907.....	408,605.13
Included in this is engineering...	27,834.54

The cost of the engineering was 7.49 and 6.81 per cent. of the total expenditure.

H. V. HINCKLEY, Consulting Engineer.
Oklahoma City, Okla.

Screened vs. Pit-Run Gravel.

With the possible exception of a few cases, such as urging some home remedy for the croup or prescribing "rock and rye" for a cold, few sane persons will attempt to give the doctor pointers on his profession. Yet "practical men" and "public-spirited citizens" consider it their right and their bounden duty to indicate to the engineer the error of his way and to offer suggestions relative to the practice of his profession. This attitude is always particularly noticeable when a change or a rigid enforcement of specifications is the point under discussion. The following item, clipped from a Peoria paper, is indicative of this tendency:

For the first time in the history of paving operations in Peoria screened gravel was used this morning in making the concrete for the foundation. Hitherto nothing but pit-run gravel has been used, and the innovation comes in the paving of Franklin street.

City Engineer Canterbury states that hereafter all paving specifications will call for screened gravel, and this ruling has caused much dissatisfaction among paving contractors and property owners who will be called upon to pay for the coming street improvements. The difference in cost between screened and pit-run gravel is about 25 per cent., and this alone will increase the cost of the proposed paving of Elizabeth street, from Chambers avenue to the Knoxville road, in the sum of $4,600.

Paving contractors and cement workers are agreed in the expressed opinion that the substitution of screened gravel for pit-run gravel is the rankest folly. Sand is an essential component in the formation of concrete, and if screened gravel is used the sand is to be added to make a compact foundation. In the pit-run gravel the sand is already there, and therefore it is regarded as sublime idiocy to screen the sand out of the gravel and then put it back when the concrete is made, to say nothing of the extra cost involved.

These facts are being brought before the board of local improvements at its meeting this afternoon, in the endeavor to induce it to insist that in drawing up its specifications for street paving the city engineer return again to pit-run gravel in the interest of common sense and economy.

H. Y. CARSON, Danville, Ill.

Electrolytic Treatment of Sewage at Oklahoma City.

The electrolytic system of sewage disposal at Deep Fork, near the country club, as installed by A. J. McMahan, was accepted by the board of city commissioners as the official system for the city.

This system has undergone thorough tests by the city and state bacteriologists and the report of the city bacteriologist showed that one trough eliminated 99.75 per cent. of the disease germs and the other 99.82 per cent. The state bacteriologist's test taken at a different time showed that the two troughs

eliminated 98.5 and 98.4 respectively.—*Oklahoma News.*

To the Editor of MUNICIPAL ENGINEERING:

Sir—We are advised that the above is the result of a six months' test of the eliectrolytic treatment of sewage—first tried at Santa Monica more than three years ago. The Santa Monica plant after a three years test has been doubled in capacity to take care of a greater population. The Oklahoma City plant discharges its effluent into a dry gulch and the six months covered by the test has been the driest for many years. The adoption of the electrolytic as the official sewage treatment for the city means more plants for Packingtown and the business district at an early date. H. V. H.

The Effect of Public Service Commissions Upon Securities Operating Thereunder.

The following from the "Readers' Investment Bureau" of the *Review of Reviews,* which advises inquirers regarding investments is of interest in connection with the editorials on the above subject in MUNICIPAL ENGINEERING, vol. xl, p. 425, and on another page of this issue:

By public service corporations we mean corporations engaged in the business of supplying transit facilities, water, gas, electricity and power to the inhabitants of the various communities. Securities of corporations engaged in a business of this kind in the State of Wisconsin have an excellent standing for the reason that such corporations are regulated by one of the most comprehensive laws to be found on the statute book of any of the states. New York and Massachusetts are the only States we can recall at the moment which have laws on the same plane of efficiency as those of Wisconsin in this respect.

Reinforcing Wooden Poles with Concrete.

The overhead department of the Indiana Union Traction Company, Anderson, Ind., this year is reinforcing about 1,600 of its trolley poles. Last year about 700 poles were reinforced and during the late fall of 1909 similar work was done on 250 to 300 poles. The method employed is, briefly, as follows:

An excavation to a depth of 24 in. to 28 in. is first made around the pole. The rot around its base is then shaved off and a thorough application of creosote is given the pole from the bottom up to a height of 3 ft. or 4 ft. above the ground. For installing the concrete reinforcement thirty-six forms, 48 in. long and ranging in diameter from 18 in. to 24 in., are used. These are constructed of black sheet iron and are made in semi-circular halves. Semi-circular bands are riveted to the iron to hold the forms in shape, the edges of the forms being hinged together, thus permitting easy handling and assuring that halves of the same size are kept together. With thirty-six forms four men can be kept busy concreting.

A form of the size most nearly conforming to the size of the pole is laid around it, and inside this form is placed wire reinforcement consisting of 46-in. twelve-bar heavy wire fence, with No. 7 top and bottom wires, No. 9 intermediate horizontal wires and No. 9 vertical wires spaced 3 in. apart. This fencing is cut in lengths sufficient to encircle the pole and be embedded in the concrete just inside the forms. The form is then filled with concrete consisting of one part cement to five parts gravel and sand. The top is sloped off slightly to assist in shedding water from the top of the concrete and around the pole. The form is removed from the pole after about twenty-four to thirty-six hours. After the forms have been removed the dirt is tamped in around the concrete and the pole is coated with a heavy paint or pitch compound around the top of the concrete to eliminate as nearly as possible the entrance of moisture between the concrete form and the pole.

The reinforcement is being applied to 30-ft. and 40-ft. poles, although the latter size poles are thought to be good for a considerable length of time. The 30-ft. poles, however, are believed to be near the maximum limit of their life without some form of protection and therefore reinforcement, as described, has been applied.

G. H. Kelsey, superintendent of power, has charge of the work and devised the above method.

Paving in Mason City, Iowa.

A total of thirty-one blocks of pavement, all of it cement, was laid by Mason City this season according to figures of the engineering department. The total cost of the cement pavement was $14,850, or an average of $1.35 per square yard. The city now has 110 blocks of pavement, or a little more than six and one-fourth miles. The total cost of the cement pavement as laid is $70,200 for fifty-two blocks; for brick pavement, $70,560 for thirty-six blocks; for asphalt, $21,830 for seventeen blocks; and $11,750 for five blocks of creosote blocks. The cost per yard for the cement was $1.35; for brick, $1.96; for asphalt, 89c, and for creosote block, $2.35. The asphalt and creosote blocks were laid some years ago.

The Municipal Power Plant of Winnipeg, Canada.

Winnipeg's civic power plant was put in operation in October and current for lighting was successfully transmitted from the big Point du Bois station on the Winnipeg river. The city is enabled to do its own lighting and is rounding into shape to serve a long list of customers who have signed contracts to use civic light and power at prices much below those that have prevailed in the city heretofore.

MUNICIPAL MATTERS IN COURT

Higher Courts.—Damages for Illegal Use of Roads.—Milwaukee's Free Legal Bureau.

Decisions of the Higher Courts of Interest to Municipalities.

Extras Must be Paid When Provided in Contract.—A provision in a contract to construct a bridge that a specified sum is to be in full compensation for the cost of the entire work, and that the city shall not be liable for extras of any kind, is modified by a subsequent provision authorizing additional compensation for extra work in making the excavations for piers and abutments on encountering material different from that disclosed by the borings forming a part of the plans, and the contractor by complying with tation of claims may recover for such work. Capital City Brick and Pipe Co. v. City of the provisions of the contract as to presen- Des Moines (Iowa), 132 N. W. 188.

Paving Company Not Liable for Damages Due to Unrepaired Pavement.—A contract by a paving company with a city provided that it would construct pavement in a good manner and maintain it in good condition for five years, and that "during the performance of the work * * * will place proper guards around * * * the same to prevent accidents and * * * keep suitable lights and save the city harmless against suits for damages," and also provided by another clause that it would repair and make good to the satisfaction of the engineer any cracks or depressions which should occur within five years from acceptance and when notified by the president, and that the contractor would, within five days of the receipt of notice, restore the pavement over all opening made by corporations. *Held*, that where a telegraph company within the five years opened a portion of the pavement, and the paving company after notice failed to restore it, and an accident occurred and the city was sued for injuries, the paving company was not liable to the city. City of New York v. Sicilian Asphalt Paving Co. et al (N. Y.), 130 N. Y. S. 468.

Owner Not Liable for Water Rental of a Tenant.—The charge made by the city of New York for water furnished through a meter is not a tax, but a contract obligation between the city and the actual consumer who is the principal debtor, though City Charter of Greater New York imposes a lien on the premises as security for the payment thereof; the relation of the owner to a charge for water furnished to another occupying the premises being that of surety. Rankin v. City of New York (N. Y.), 130 N. Y. S. 427.

Councilman Ousted for Cause May be Reelected.—Where, being ousted from office by decree of court, because a stockholder in a corporation furnishing supplies to the borough, a borough councilman immediately sells his stock, resigns his office, and is reelected by the council, the council having authority to fill vacancies in its body, all these actions being taken bona fide, he has a colorable title and becomes and continues a councilman de facto till a decree for a second ouster, and in the meantime his votes and acts are forceful and binding, where public interests are concerned. Warren et al v. Coatesville Borough et al (Pa.), 80 A. 576.

Regulations to Prevent Water Waste Are Reasonable.—Regulations for municipal water service to individuals, prohibiting use of hose, rams, syphons, etc., except when the premises are metered, requiring consumers to keep pipes in repairs and to prevent waste, etc., are reasonable. Johnson-Kahn Co. v. Thompson et al (N. Y.), 130 N. Y. S. 216.

Private Water Company May Be Taxed to Support a Municipal Plant.—A water company holding a franchise to operate its system within a portion only of the limits of a village is subject to taxation of its property located within the village for the purpose of paying bonds issued and expenses incurred for the maintenance of a municipal water system installed subsequently to that of the water company. When a municipal corporation is created the power of taxation is vested in it as an essential attribute for all the purposes of its existence, unless its exercise be in express terms prohibited.—Beauty Springs Water Co. v. Village of Lyons Falls (N. Y.), 130 N. Y. S. 875.

City Liable for Negligence of Its Contractors. Though a city might not be liable for injuries by obstructions on a sidewalk placed there by other than the city's agencies, because the board of police commissioners had sole authority to abate such nuisances, the rule would not apply where the obstruction was placed in the street by the city's contractors over which it had con-

trol. Where the agreement between a city and contractors putting in a sewer required the work to be done under the supervision of the city engineer, with whose directions the contractors were required to comply, the contractors were not independent contractors, so as to relieve the city from liability for injuries to a pedestrian by falling over a manhole frame temporarily placed by the contractors on the sidewalk.—McCarthy et al. v. Clark (Md.), 81 A. R. 12.

Contractor Not Responsible for Injuries if Warning Signs Are Stolen.—Where, in an action against a city and sewer contractors for injuries by falling over a manhole frame temporarily placed on a sidewalk by the contractors, the pleadings and evidence raised the question of negligence in placing the frame on the sidewalk as well as in not having it lighted, a requested prayer was properly refused that, if the contractors had a light placed on the manhole frame which was removed without their knowledge, they were not negligent; such prayer ignoring the other questions of negligence.—McCarthy et al. v. Clarke (Md.), 81 A. R. 12.

Damages on Condemnation Proceedings Must Be Prepaid.—Under the act which provides that a municipal corporation having the power of eminent domain shall make just compensation to be ascertained by law for the property taken, injured or destroyed, by the construction of its highways, which compensation shall be paid before such taking, injury or destruction, and which, after securing the right of appeal and the right to have damages determined by the jury, provides that such appeal shall not deprive one who has obtained a judgment of condemnation of a right of entry, provided the damages assessed shall have been paid into court in money, the rights of an owner who files a bill to enjoin a street grade improvement until he should be compensated for the injury to his abutting property are protected by an order of reference to ascertain full indemnity to the owner and costs, and a deposit with the register of the amount so ascertained to abide the result of the suit.—Stocks v. City of Gadsden (Ala.), 56 S. R. 138.

Municipality Is Liable for Damage Due to Diverted Water.—When a municipality in the improvement of its streets diverts water from its natural channel so that it passes over and injures land which it did not injure before the construction of the improvement, the municipality is liable.—City of Jasper v. Barton (Ala.), 56 S. R. 42.

Petition Necessary Before Street Grade Is Changed.—Since under an act providing that no change of an established street grade shall be ordered by city council, except on petition of the owners of a majority of the property affected by the proposed change, a petition for such change, signed by the requisite number of competent property owners, is a condition precedent to the making of an order for a change, and the city council has no power to order a change until a sufficient petition is filed, and since such an improvement directly affects private property, an order of the council directing the improvement was not a conclusive adjudication that a sufficient petition had been filed, there being nothing in the staute giving the order such effect, so that, if the petition was not sufficient to confer jurisdiction, it was subject to collateral attack in any action involving the validity of the proceedings.—Wilcox v. Engebretson et al. (Cal.), 116 P. R. 750.

Contractor's Cook Is Not Connected with Work.—A certain act provides that a contract made expressly for the benefit of a third person may be enforced by him. A contractor with a city for the construction of a tunnel agreed to protect it from "all claims and liens of any kind whatsoever connected with said work," and authorized the city to withhold money due by him to his laborers or other workmen. Held, that a cook for the laborers engaged in the construction of the tunnel was not "connected with said work" and could not enforce the provisions of the contract as against the contractor.—Clark et al. v. Beyale et al. (Cal.), 116 P. R. 739.

Board of Appraisal Is not Entitled to Compensation for Dilatory Work.—As the commissioners of appraisal engaged in estimating the value of land condemned by the board of water supply had power to organize its business and insist upon punctual attendance by parties and prompt submission of the evidence under the penalty that follows default, they are not entitled to compensation upon the scale of full days, where they allowed the proceedings to drag along, and the sessions lasted only a few hours each day.—In re Simmons et al. Board of Water Supply (N. Y.), 130 N. Y. S. 773.

Fire Damages Cannot Be Obtained on Basis of Low Water Pressure.—A property-owner and taxpayer in a city has no right of action against a water company on its contract to furnish water to the city at public hydrants, for fire purposes, a pressure of 150 pounds and a sufficient supply of water for a certain length of time, for damages to his property by fire occasioned by the company's failure to furnish pressure and supply of water as it had contracted, since there is no privity of contract between such owner and the water company which will allow him to sue for a breach of the contract with the city.—Collier et al. v. Newport Water, Light and Power Co. (Ark.), 139 S. W. R. 635.

Right to Purchase and Renewal Privilege of a Franchise Constitute Alternative Courses of Action.—The city of Denver, by an ordinance which was accepted and under which the company expended several million dollars, granted a franchise to a water company for 20 years, the limit of its power,

and also contracted to pay for the maintenance of fire hydrants. The ordinance provided that at the expiration of the term the city should have the right at its election to purchase the property of the company, its value to be appraised in case of disagreement, the company's franchise to then cease. By a following provision the city was given the right at its election to renew the franchise of the company at the end of the term for another 20 years with a reduced rental for its hydrants. Held, that, in view of the nature of the business for which the franchise was granted, the shortness of the term, and the large expenditures which must necessarily be made and continued through the term to give adequate service in a young and rapidly growing city, such two provisions of the ordinance contract should be construed together as requiring the city to purchase the property at the end of the term, if it did not renew the franchise; it not having power to bind itself by a contract to renew, but having power under the statute to contract to purchase if it should choose not to renew.—City and County of Denver et al. v. New York Trust Co. et al. Same v. Denver Union Water Co. (Colo.), 187 F. R. 890.

City Must Maintain Adequate Channel for Water Supply.—Where a city diverts a stream of water from its natural channel and undertakes to convey the same by means of an artificial channel or canal, it should be held liable for the exercise of reasonable care and diligence in constructing a channel of sufficient size to carry the volume of water that may be reasonably anticipated or expected to flow down the same and for the maintenance of the same in a reasonably safe condition.—Wilson v. Boise City (Idaho), 117 P. R. 115.

City Is Not Exempt from Damages Due to Exceptional Natural Causes.—A municipality will not be exempt from liability for damages on account of failure to maintain a sufficient artificial channel to carry off the water of a stream that it has diverted from its natural channel, merely on the grounds that the flooding and overflow was caused by an unusually heavy rainfall or cloudburst, the like of which has not usually occurred, where it appears that a number of such rainfalls or cloudbursts have occurred in the same locality within the last preceding 15 or 20 years.—Wilson v. Boise City (Idaho), 117 P. R. 115.

Distribution of Cost of Public Improvements Must Be Determined by Municipal Officers—Whether the cost of a public improvement shall be borne wholly by the property benefited, wholly by the public, or in part by each, are questions for the municipal officers, whose determination the courts cannot control. The determination of assessing officers as to the amount assessed upon specific tracts for public improvements is ordinarily conclusive upon the courts and will not be disturbed unless the assessment is so disproportionate to the benefits as to amount to confiscation.—Powell v. City of Walla Walla (Wash.), 117 P. R. 389.

Bond Election Void if Different Questions Are Not Separately Stated.—An ordinance which states the purpose of a proposed issue of municipal bonds as follows: "That it is the purpose and intention of the chairman and board of trustees of the village of Salmon City to incur such indebtedness and issue such bonds in the total amount of fifty thousand ($50,000) dollars, thirty thousand ($30,000) dollars of which amount shall be used for the purchase of the waterworks, water rights, system and franchises of the Salmon City Water Company, Limited, and that an amount not to exceed the sum of fifteen thousand ($15,000) dollars of such indebtedness and bonds shall be used to enlarge and extend the said waterworks and water system, and an amount not to exceed the sum of five thousand ($5,000) dollars shall be used for the purchase, erection, construction and furnishing of a public building and building site for the use of such village," states two separate and distinct purposes and questions, and the ballot used at the election which requires the voter to designate thereon his vote either for or against the single proposition of favoring or disapproving the issue of the aggregate amount of the bonds proposed does not give the voter an opportunity of expressing his will upon each of the purposes and questions incorporated in the ordinance.—Estrander v. City of Salmon (Idaho), 117 P. R. 692.

City Must Not Protect Grass Plots by Injurious Barriers.—While a city could protect grass plots along sidewalks by suitable barriers, it was negligent in stretching a small, dark wire on stakes about a foot from the ground, along the edge of the grass plot; such wire being calculated to cause injury to pedestrians rightfully attempting to cross the plot.—City of Paducah v. Simmons (Ky.), 139 S. W. R. 851.

City Responsible for Assessed Improvement Work.—Where a contract for the paving and grading of streets provides that the fund for the payment of the contract price is to be derived from assessments on the property benefited, and that the city is to be liable only for the amounts actually collected from the assessments as they are collected, but the city delays for four years and more after the completion of the work to make collections, it is liable for the contract price out of its general funds, though it has filed liens and issued writs of scire facias within the time prescribed by law. Where a contract for the paving and grading of streets provides that the fund for the payment of the contract price is to be derived from assessments, but after a delay of more than four years in making collections the contractor sues the city, he is entitled to interest from the completion of the work, and not from the

date from which interest accrued on the assessments.—Dale et al. v. City of Scranton (Pa.), 80 A. R. 1110.

Collection of Damages for Improper Use of a Highway.

In a decision recently rendered by the Court of Appeals of Kentucky (Commonwealth v. Prall, 139 S. W. R. 798) it was held that one who materially damages a road by unusual use must repair it; further stating that he was guilty of obstructing the road and could be fined for failure to make the needed repairs.

The road in question is known as the Bardstown & Bloomfield Turnpike, and it is a macadamized road; that is, constructed of Telford paving, with crushed or knapped stone on top. The unusual use made of it, as shown by the evidence of the commonwealth, was in hauling over it, from a point nine miles east of Bardstown to the railroad station at the latter place, in wet weather and during thaws, wagons containing loads of extraordinary size and weight, consisting of large sawlogs, in many instance as many as six to the load. According to further evidence of the commonwealth, no other loads of such size or weight were ever hauled over this turnpike, and their unusual and unnecessary weight, together with the unseasonableness of the weather, rottenness of the ground and reckless driving of servants in charge of the wagons and teams, caused the turnpike to be torn up in places and much of its Telford paving and top metal to be displaced, thereby producing holes and ruts in the roadbed, some of them as much as 6 and 12 inches in depth; these conditions being particularly prevalent on hilly parts of the turnpike, where teams in going down the grades, were unable, on account of the great weight of the loaded wagons, to hold them back, and were allowed by the drivers to run the wheels of the wagons on and over the edges of the turnpike, thereby removing and destroying its curbstones. There can be little doubt that if the foregoing injuries resulted to the turnpike from unusual and unnecessary use of it, as shown by the evidence, it materially damaged it in fact and in the meaning of the statute. Indeed, the evidence introduced did not materially refute this fact, but was mainly directed toward showing that the damage caused to the pike was not as great as stated by the commonwealth's witnesses, and that injury also resulted to the turnpike from the wagons of others.

It was, however, stated that in a proceeding to recover a fine for damaging a highway by its unusual use in hauling and refusing to repair it, evidence was not admissible that hauling by others also damaged the road, if it did not show that the particular damage alleged in the petition was caused by such other hauling.

Free Legal Aid in Milwaukee.

A report has been submitted by a bureau appointed by Mayor Emil Seidel, of Milwaukee, to investigate the question of free legal aid. A bill before the Wisconsin Legislature failed of passage, but the organization of a voluntary bureau similar to those of New York and Chicago is urged.

In spite of the fact that Milwaukee has a population of 370,000, the majority of whom are wage earners, the city has no organized free legal service for persons unable to hire an attorney. A precedent for this form of public service is found in New York, Chicago, Philadelphia and several other cities where the "poor man's lawyer," supported by a private charitable society, has already become an established institution; and in Kansas City, where the advanced step of maintaining a legal aid bureau as a regular part of its city administration has recently been taken.

The method of operating these bureaus is practically the same whether under private or public management. One or more lawyers, serving on salary, are placed in charge and are given assistants who act as paid investigators to inquire into the circumstances brought out by an office interview with the applicant.. In addition, occasional legal advice is rendered by attorneys who serve without pay. In Kansas City, six city attorneys each give two hours of their time during a single week. In the work of the private societies a small fee is charged. The Philadelphia society requires the applicant to pay 25 cents as a retainer, if possible, as well as the costs of any proceeding, and collects 10 per cent as a contingent fee in all cases where the amount recovered is over $10.

Failure to obtain justice in some cases is urged as a reason for free legal aid and a radical change in court procedure, such as the frequently advocated establishment of a system of public defense conducted on lines similar to present public prosecution, is recommended by the report.

Corporation Fined for Obstructing River.

The Great Lakes Dredge and Dock Company was recently fined in the sum of $2,500 for dumping debris into the Chicago river. According to the evidence, the Great Lakes Dredge and Dock Company had a contract to build docks for Albert Pick & Co. at Thirty-fifth street and the south fork of the river. Much excavating was done, and, instead of carrying the debris away, as is required by law, the company dumped it into the river, filling up the stream so that navigation was impossible. In March government inspectors warned employes of the dock company whom they found shoveling dirt into the river, and later a suit was brought against the company with the result above stated.

Highway Laws of Pennsylvania.—Rochester's Street Improvement.—Road Progress.

Highway Laws of Pennsylvania.

In a paper presented before the convention of the American Road Builders' Association, in Rochester, N. Y., on November 14 to 17, Jos. W. Hunter, Assistant Commissioner of Highways of Pennsylvania, gave a resume of the highway laws of the State. The following abstract gives the main points of this paper:

The laws governing the public highways of Pennsylvania followed the old English laws of George III, which, in turn, were a consolidation of the old Roman law and of the statutes of Henry VIII and of Philip and Mary. The act of the General Assembly of 1836 consolidated all other acts and became the general law governing the highways of the State until the passage of the highway act of April 15, 1903, which was reenacted with amendments by the act of assembly approved May 1, 1901, which act created the State Highway Department, under which the work of reconstructing township roads with the co-operation of townships and counties, was inaugurated and carried on. The initiative of all State aid work under this law was with the township, and until a township made an application asking for State aid in reconstructing a road no work could be done by the department. After a road had been reconstructed the maintenance of said road was placed on the township, and as a consequence the roads were not maintained. Under this system of State aid 850 miles of township roads have been reconstructed. The act of Assembly, approved April 12, 1905, supplemented by the act of June 14, 1911, changed, in a great measure, the system of maintaining the earth roads in the State, placing them in a great measure under the care and supervision of the State Highway Department. This law provides for the abolishing of the road work tax absolutely and places all the townships on a cash road tax basis, the State agreeing to pay a bonus of 50 per centum of the amount of cash raised by a township, provided, however, that the money appropriated by the State shall be expended by the townships in permanent improvement under the supervision of the State Highway Department. The department is to furnish plans for bridges, culverts and make surveys and plans for changes of grade and to supervise the work without cost or charge to the township in which the improvement is being made.

The acts of 1903 and 1905, with their supplements and amendments, were repealed and the State Highway Department was reorganized by the act of May 31, 1911, which act authorizes a system of state highways to be constructed and maintained at the sole expense of the commonwealth, and also a system of State aid highways, in the construction of which the State co-operates with the counties and townships, and in certain instances with boroughs, the State paying 50 per cent. and the county and township each 25 per cent. of the cost. The State will maintain all State aid roads and collect 50 per cent. of the cost thereof from the respective township or borough in which the road may lie.

The State Highway Commissioner is appointed by the Governor with the advice and consent of the Senate, for a term of four years. He gives bond in the sum of fifty thousand dollars for the faithful performance of his duty and appoints as an assistant to the chief engineer an engineer of bridges, who shall be a capable and competent civil engineer, experienced in the designing and construction of bridges; he also appoints fifteen civil engineers; he also appoints a chief draughtsman, who shall be a civil engineer, four assistant draughtsmen, a chief clerk, eight additional clerks and stenographers, two bookkeepers and such other additional clerks and stenographers as the work of the department requires. He also appoints fifty superintendents of highways. The Governor appoints two deputy highway commissioners, to be known as First Deputy State Highway Commissioner and Second Deputy State Highway Commissioner, respectively, one of whom shall be a competent civil engineer. They each give bond in the sum of twenty-five thousand dollars. They are subject at all times to the authority of the State Highway Commissioner; he also appoints an auditor for the said department, who shall be a certified public accountant; he gives bond in the sum of

twenty-five thousand dollars. The Governor also appoints a chief engineer of the department, who shall be a capable and competent civil engineer and experienced in the building and maintenance of improved roads.

The new highways act provides for the taking over by the State Highway Department on or before June 1, 1912, of 7,900 miles of township roads, as described in 296 routes, to be known and designated as state highways and, when so taken over, shall thereafter be constructed, improved and maintained by the State Highway Department at the expense of the commonwealth; this taking over, however, will not include any portion of a turnpike which at the present time is a toll road. These toll roads will not be taken over until after the money becomes available from the proposed bond issue. This proposed bond issue will be in the form of an amendment to Article IX of the State Constitution, Section 4, which reads as follows:

"Section 4. No debt shall be created by or on behalf of the State except to supply casual deficiencies of revenue, repel invasion, suppress insurrection, defend the State in war, or to pay existing debt; and the debt created to supply deficiency in revenue shall never exceed in the aggregate, at any one time, one million dollars."

And which, when amended, will read as follows:

"Section b. No debt shall be created by or on behalf of the State except to supply casual deficiencies of revenue, repel invasion, suppress insurrection, defend the State in war, or to pay existing debt, and the debt created to supply deficiencies in revenue shall never exceed in the aggregate, at any one time, one million dollars: Provided, however, that the General Assembly, irrespective of any debt, may authorize the State to issue bonds to the amount of fifty millions of dollars for the purpose of improving and rebuilding the highways of the commonwealth."

This resolution will again be before the Legislature for action at the session of 1913, and if again approved by that body will come before the citizens for ratification or rejection by them at the next state election, and if ratified by the people, then the General Assembly may authorize the State to issue bonds to the amount of fifty million dollars for the purpose of improving and rebuilding the highways of the commonwealth. Until the money from the bond issue becomes available, the amount of work to be done by the State Highway Department in the reconstruction of state highways will be limited and confined to the appropriation made by the Legislature at the regular sessions.

The act also prescribes a method of taking over all the turnpikes or toll roads; also prescribes a method of reconstructing roads, streets and highways in boroughs and incorporated towns. The act also permits the State Highway Commissioner to change the location of a route if, in his opinion, it is dangerous or inconvenient to the traveling public as at present located. Any such change in route must have the approval of the Governor.

The act provides that all highway improvement and construction or rebuilding under the provisions of this act shall be macadam, telford or other stone roads, or constructed of brick, gravel, cinders, oyster shells or other good materials, or combination of materials, in such manner that the same, of whatever materials constructed, will with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel. The selection of materials to be made by the State Highway Commissioner and the improved portion of the road constructed shall be of a width of not less than twelve feet.

The act also provides for a system of State aid roads similar to that provided for by the act of May 1, 1905. Applications for State aid work are to be filed as heretofore, the State, however, paying fifty per cent. of the cost of reconstructing these roads, the county and the township each paying one-fourth the cost thereof. Under the old law the State paid seventy-five per cent. of the cost of reconstruction. The act also provides that the State Highway Department, in the construction of State aid roads, can make a contract for the amount of money to be contributed by the State plus the amount of money to be paid by the county and township respectively. It also provides for the marking of the State highways and for the erection of suitable sign boards at main cross-roads. An appropriation of three million dollars is provided to be used to establish and carry on the work of the department and for the purpose of maintenance, repairing and construction of State highways therein described, and for the payment of the State's share of the maintenance and repair of State aid highways heretofore constructed or improved under the provisions of this act. The work of maintaining all State aid roads will be done by the State Highway Department and fifty per cent. of the cost thereof collected from the township or borough or incorporated town in which said State aid roads have been reconstructed. The sum of one million dollars is appropriated by the act to carry out the provisions thereof in the reconstruction of State aid roads. This sum, when increased by the shares of the counties and townships, will give the sum of two million dollars for State aid work. About six hundred miles of road already reconstructed by the State Highway Department are included in the routes designated in the Sproul law as State highways.

The work of reorganizing the department on lines to put into effective operation the law will require time, but it is the intention

of the commissioner to carry on the work of maintenance, repair and construction of State highways as equally and uniformly in the several counties as conditions will allow, and at the same time do as much State aid work as the available funds will permit.

Rochester's Street Improvement Record.

All records for street improvements in the way of pavements, sewers and walks in Rochester, N. Y., were broken in the present year, according to the figures of the engineering department and the board of contract and supply. Thus far in 1911 contracts have been let for pavements costing $1,074,990 and for sewers costing $395,503.

A large proportion of the improvement contracts have been completed. It is not believed that any more important work will be authorized this year, as the cold weather is an effective barrier to everything except sewers. Contracts may be let with the proviso that work shall be begun as soon as practicable in the spring.

Recent Progress in the Good Roads Cause.

(Continued from the November issue of MUNICIPAL ENGINEERING.)

MISSISSIPPI.

There has been very little activity in road improvement in Mississippi. It is reported that only 0.86 per cent. of the roads in the state have been improved.

It is estimated that there are 44,004 miles of road in the state. In response to a recent request one-half the counties in the state reported, and nine of them reported 144 miles of gravel road, from one to thirty-one miles per county. Eighteen counties report from $15,000 to $200,000 of bonds issued to pay for good roads, amounting to $1,130,000, which is probably about half the total bond issues by counties. Twenty counties report the use of convicts on the roads, with varying success.

Hinds county reports a $200,000 bond issue by two districts for gravel roads, and twenty miles under contract. Four miles were built in 1911 at a cost of about $3,500. The working of the 800 miles of road in the county is let by contract for three years, and costs about $40 a mile.

The local roads are in charge of the county boards of supervision, elected one from each of five districts into which each county is divided. One overseer is appointed for each supervisor's district.

Mississippi has a population of 1,797,114, which is increasing about 15 per cent. per decade, and its 79 counties range in population from 6,000 to 64,000.

MISSOURI.

The Missouri highway law was passed in 1907, under which Curtis Hill, Columbia, is state highway engineer, under the state board of agriculture.

Prior to 1910 $475,000 had been spent in state aid of construction of roads. In 1910 $75,000 was spent and the appropriations for 1911 aggregate about $300,000. The state pays half the cost of state aid roads and the other half is paid by the county, the township or the abutting property.

Of the 107,923 miles of road in the state 4,756 have been improved. The cost of build- roads is reported to be 48 cents per square yard for macadam, 27 cents for gravel and $1.20 for bituminous surfaces. Individual macadam roads have cost from 33½ cents to 56 cents per square yard or $1,769 to $5,120 per mile. The route for a state road from St. Louis to Kansas City was recently selected.

The local roads are in charge of the county court of three judges and the county road engineer. Each county is divided into road districts of six school districts or more, and an overseer is elected for each district.

Missouri has a population of 3,293,335, which is increasing more than 5 per cent. per decade, and its 115 counties range in population from 6,000 to 284,000, not including the city of St. Louis.

MONTANA.

The information at hand regarding Montana roads is very meager. The local roads are in charge of boards of county commissioners of 3 members each, who divide their counties into suitable road districts and appoint a road supervisor for each. Automobile clubs are agitating for the granting of federal aid for road building in the state.

Montana has a population of 376,053, which is increasing nearly 55 per cent. per decade, and its 28 counties range in population from 3,000 to 57,000.

NEBRASKA.

But little has been done as yet toward state aid of road improvement in Nebraska, the only aid heretofore having been toward construction of bridges.

The local roads are in the hands of the boards of county commissioners of 3 members each and the county surveyor. In counties having township organization the township boards have direct charge of the roads in their township. In those having no township organization the counties are divided into road districts and an overseer is appointed for each district.

Nebraska has a population of 1,192,214, which is increasing over 11 per cent. per year, and its 92 counties range in population from 1,000 to 169,000.

NEVADA.

Plans for construction under the new state highway law were not matured until June, 1911. Since then 2 miles of first-class macadam road have been constructed and 3 miles have been graded ready for macadam on a road from Carson City to Reno. Later

a highway from Carson City to Lake Tahoe is planned to connect with the California state highway recently built. W. M. Kearney, Carson City, is state engineer.

The last legislature authorized the use of convict labor on the roads.

The appropriation for 1911 is reported to be $20,000.

Local roads are in the charge of boards of county commissioners of 3 members each, who divide the county into road districts and a road supervisor is elected for each.

Nevada has a population of 81,875, which is increasing neary 95 per cent. per decade. and its 15 counties range in population from 2,000 to 17,000.

NEW HAMPSHIRE.

The New Hampshire road law was originally adopted in 1903. The state roads are in charge of the highway department, with H. C. Hill, Concord, as state engineer. Towns are required to raise money for taxation for road purposes, from 25 cents to $1 per $1,000 assessed valuation being so raised. To secure state aid 50 per cent. additional to the sum so set apart far main highways must be raised. The aid then granted by the state varies from 20 cents to $3 for each dollar which is so raised by the local authorities. The total expended for state aid prior to 1911 was $706,605, and also $497,929 for trunk line roads. The appropriations for state aid in 1911 were $125,000 and for trunk line roads $250,000. Work in 1911 did not begin until September, so that nothing can be said of this year's work.

Of the 15,116 miles of road in the state 1,448 have been improved. State aid roads completed prior to 1911 measure 248.1 miles, and trunk lines constructed by the state measure 254.3 miles.

The average cost of roads constructed is reported to be 78 cents per square yard for macadam, 39 cents for gravel and $1.05 for bituminous surfaces.

Highways are maintained by the local authorities.

Of the 194.2 miles of road constructed with state aid in 1910, 57 miles were macadam, costing $6,539 per mile; 135.8 miles were gravel, costing $3,356 per mile; and 1.4 miles were bituminous macadam, costing $7,709 per mile. No state roads were constructed in 1910, the available funds being used in maintenance of roads already built.

In 1909 there were built 58.44 miles, of which 4.6 miles were trap-work macadam, costing $6,900 per mile; 6.04 miles were native stone macadam, costing $5,300 per mile; 46.5 miles were gravel, costing $3,450 per mile; and 1.3 miles were bituminous macadam, costing $7,800 per mile.

Local roads are in the charge of boards of county commissioners of 3 members each and of the selectmen in the towns. Three highway agents are elected in each town to have charge of the road work under the selectmen. Funds for local roads are raised at annual town meetings, and must equal at least one-fourth of 1 per cent. of the property valuation of the town.

New Hampshire has a population of 430,572, which is increasing nearly 5 per cent. per decade, and its 10 counties range in population from 16,000 to 126,000.

NEW JERSEY.

The original of the present New Jersey state aid good roads law was passed in 1891, but numerous amendments and additions have been made. The department of public roads, of which E. A. Stevens is commissioner and R. A. Meeker is supervisor, has a consulting and advisory character, rather than one of immediate direction. The subordinate force consists of two assistant supervisors, and estimator, a secretary and a clerk. Plans, profiles and specications are prepared by the county authorities and contracts are let by them, but, as nothing can be done without the approval of the state commissioner, it results that the state prepares standard specifications which receive only such modifications by the local authorities as local conditions require. Stone, gravel, bituminous macadam, asphalt concrete, and macadam with surface dressing of heavy asphalt oil are the classes at present standardized.

In 1892, the first year under the state aid law, 10.55 miles of road were constructed in one county. Since that date the yearly construction has varied from 27.34 miles to 154.74 miles per year, and the total, including 1910 and roads under construction to be completed in 1911, is 1,562.2 miles. The state's share of the cost of these roads has been $3,059,883. The total cost of these roads is three times this sum.

The law provides a process of petition for roads in a county, selection of the roads to be improved with the available funds of the year by the board of chosen freeholders of the county, with the approval of the state highway commissioner, when one-third the cost will be set aside by the state to aid in paying for the road, provided the total for all the counties of the state so set aside shall not exceed $400,000 a year. The local funds raised for road construction and repair cannot exceed one-fifth of 1 per cent. of the assessed valuation of the county. The state commissioner selects the supervisors in charge of the construction of the various roads, and they are paid from the state appropriation for the roads on which they are employed. Repairs must be made by the county under the county supervisor, and, if not made, the state commissioner may withhold any state funds due or coming due to the county until satisfactory repairs have been made. The county supervisors are appointed to oversee repairs and are removable by either the county board

or the state highway commissioner. The act applies to all organizations in the state except cities, and any of them can construct roads under its provisions. By other laws the owsership of two-thirds of the property along the road proposed to be improved may agree to pay 10 per cest. of the cost of a road when the cousty must construct it; a county engineer is provided for in addition to the county supervisor; for two assistant supervisors in the state commissioner's office, to supervise the expenditure of the funds from automobile licenses in the repair of roads; for an ocean boulevard from Atlantic Highlands to Cape May; for the Henry Hudson drive in the Palisades Interstate Park; for a scenic highway along the Delaware river; for joint construction and repair of roads through two or more counties and for paving roads.

Convict labor is used in some counties for crushing stone.

Of the 14,842 miles of road in the state, 3,378 have been improved, 1,562.2 with state aid.

The average cost of roads is reported to be 75 cents per square yard for macadam, 40 cents for gravel and $1.12 to $1.30 for bituminous surfaces. Telford roads cost 10 or 12 cents per square yard more than macadam.

The annual expenditures for repairs are indicated by the report for 1910, which shows $308,127 spent by the state from the motor vehicle fund and $1,086,169 from county funds. The receipts from the motor vehicle licenses amount to $382,000.

The proportions of various kinds of road are indicated by the construction in 1910 of 10,884 miles of macadam, 4,590 miles of telford, 17,759 miles of macadam with asphaltic binder, 1,809 miles of telford with asphaltic binder, 4,081 of oiled macadam, 15,848 miles of amiesite, and 25,403 miles of gravel, making a total of 80,374 miles.

There are hundreds of petitions on file for work in 1912.

The county roads are in charge of the county board of chosen freeholders, which has one member from each ward of first-class cities in the county, one more from each second-class city, two from each township of over 10,000 population and one from each smaller township, who appoint county supervisor and county engineer. Local supervision is also to some extent in the hands of township committees of three each, who appoint overseers.

The practical applications of the law to a county may be suggested by the following data for 1911 from Gloucester county:

Prior to 1911, 84.08 miles of road had been built by the county and with state aid, of which 46 miles were gravel, 19.48 miles were broken stone macadam, 14 miles were telford and 4.6 miles were bituminous macadam. During 1911 there were constructed 6.92 miles of bituminous roads, costing $83,122, or an average of $12,012 per mile. Of this mileage, 0.25 mile was of filbertine 30 feet wide and 7 inches thick, costing $4,300, or $17,200 per mile; 2.17 miles were of amiesite 16 feet wide and 7 inches thick, costing $26,400, or $12,166 per mile; 1 mile was of asphalt and stone, constructed by the penetration method, 16 feet wide and 8 inches deep, at a cost of $9,422; and 3.5 miles were constructed of Bermudez asphalt and stone, by the mixing method, 16 feet wide and 7 inches thick, at a cost of $43,000, or $12,286 per mile. The first road mentioned was paid for one-third by the state and two-thirds by the township; the second and fourth, one-third by the state, 56 2-3 per cent. by the county and 10 per cent. by the township; the third was paid for, $3,422 by the county and $6,000 from the state motor vehicle fund.

New Jersey has a population of 2,537,167, which is increasing nearly 35 per cent. a decade, and its 21 counties range in population from 21,000 to 537,000.

NEW MEXICO.

The original road law of New Mexico was passed in 1903, but the present good roads commission was created by the act of 1909. It is composed of the governor as chairman, the commissioner of public lands as secretary, and the territorial engineer, Charles D. Miller, Santa Fe, under whom the supervision of construction work is done.

The funds of the commission are derived from a tax of one mill on the dollar, the first of which was available for 1910.

There are about 16,920 miles of road in the territory, of which perhaps 400 are gravel and macadam. The expenditures of state funds in 1910 were nearly $67,000 upon roads, nearly 67 miles of which were completed. State aid has been used on 225 miles of completed road, and 175 miles additional have been repaired and partly reconstructed with state funds.

In progress in 1911 were 153 miles of new road; 28 miles had been surveyed and 250 miles inspected with reference to construction or repair in 1911 and 1912. The mileage of roads completed with local funds is reported to be 104. The counties have for road work the proceeds of local taxes of 3 to 9 mills per dollar, averaging some $3,000 per county per year.

Territorial convicts are worked on the roads.

The proceeds of the state road tax are about $50,000 a year. In 1910 and 1911 about $137,000 has been spent.

Local roads are in charge of boards of county commissioners of three members each, who divide their counties into three districts and appoint an overseer for each district.

New Mexico has a population of 327,301, which is increasing nearly 70 per cent. per decade, and its 26 counties range in population from 4,000 to 24,000.

STREET · LIGHTING

Sharon's Municipal Light Plant.—Municipal Ownership in Toronto.—The Development of Electric Lights.—Street Lighting in New Zealand.—Ornamental Street Lighting.—Ornamental Street Lighting in Vancouver.—Municipal Power Plant for Los Angeles.—Concrete Ornamental Posts.

Sharon, Pa., Contemplates a Municipal Light Plant.

The Sharon, Pa., council took the initial step in the matter of building a municipal electric light plant when the committee recently appointed to secure data from other towns which are operating their own plants, presented its report, showing the cost of erecting such a plant, cost of maintenance and expense of installing the necessary machinery and other equipment.

While no definite action has been taken, as yet, the council decided to investigate the proposition and to take the matter up for consideration.

A conservative estimate of the cost of installing the necessary machinery was as follows:

Power house, $7,000; two generators, 150 k. w., and exciters, $5,000; two 300-h. p. gas engines, $18,000; one six-panel switchboard, $1,000; arc rectifier equipment and lamps, $8,000; pole line equipment, which includes arc lamps, $10,000; consulting engineer, $1,000; total, $50,000.

By installing a plant of this type, two separate units, each sufficient to supply power for 350 four-ampere luminous arc lights, would be provided. The estimated cost of operating a plant is about $10,000 a year. At the present time the borough of Sharon is paying for the street lighting as follows:

149 arc lamps at $75 per year	$11,175
3 lamps at V bridge at $60 per year	120
50 gas lamps at $12 per year	600
1 man to tend gas lamps	480
Miscellaneous supplies	100
Total	$12,475

In the opinion of the committee it would be necessary to use about 300 arc lamps. To install this number of lights under the present system, even at a price of $65 per lamp, would mean an annual outlay of about $19,500, or very close to double the amount it would cost to operate a municipal plant.

The following is a list of towns lighted by contract and the amount paid per year by same:

Kittanning, Pa., 100 lamps	$30.50
DuBois, Pa., 150	45.00
Beaver, Pa., 100	65.00
Beaver Falls, Pa., 200	65.00
New Brighton, Pa., 200	65.00
Rochester, Pa., 125	65.00
Johnstown, Pa., 650	50.00
Oil City, Pa., 300	60.00
Portsmouth, Ohio, 400	48.00
Huntington, W. Va., 350	47.00

The following is an estimate of the cost of operating a plant for 10 years, including interest, depreciation, etc.:

Cost of plant	$ 50,000
Interest at 5 per cent	25,000
Cost of operating and repairs, including depreciation	100,000
Total	$175,000
Amount paid for street light at the present rate for 150 electric lights and 50 gas lights for 10 years	$125,000
Amount collected from individual consumers for 10 years, which is a very low estimate	50,000
Total	$175,000

If there were 300 lights installed and operated for 10 years at the above cost of $175,000, it would mean that the plant would be paid for in 10 years and the lights furnished at an annual cost of $51 each.

An investigation of the merits of the tungsten cluster system of lighting is being made and it is probable that such an installation will be considered. A power plant the size referred to in the report would successfully operate from 1,200 to 1,500 of these lamps.

Municipal Ownership in Toronto.

Toronto, Canada, possesses a municipal electric plant which is not only paying dividends but is furnishing current at a lower figure. On the first of January, 1908, Toronto decided to buy Niagara power from the hydro-electric commission and voted $2,750,000 to build and equip the plant needed to distribute it. An unsuccessful attempt was made to prevent the purchase by the privately owned plant who also purchased power, beginning in 1906, from a

Niagara Falls company. A reduction of rates from the private company had been sought and refused.

Since 1908 the municipal plant has forced a 40 per cent. reduction in rates from the private company and is supplying a surplus which will be used in wiping out a technical deficiency arising during the period of time that the initial consumption of power fell below the estimated quantity.

The rates charged by the municipal plant and the private corporation are given below:

Purpose	Av. City Rate per kw. hr.	Av. Co. Rate per kw. hr.
Residence lighting	4½c	8c
Commercial lighting, alternating current	4c	8c
Commercial power, alternating current	2c	4c
Commercial lighting, direct current (without storage batteries)	5c	8c
Commercial power, direct current (with storage batteries)	2¾c	4c

The Development of Electric Lights.

Maurice Solomon, A. C. G. I., M. I. E. E., has a paper in a recent issue of the English publication , Science Progress, which deals with the progress of the electric light. He mentions the fact that only five years ago the carbon filament lamp, which was invented in 1878, was the only one of the incandescent type of lamps. This carbon lamp had a life of only about 1,000 hours and consumes about 4 or 5 watts per candle power.

In 1898 the Nernst lamp was invented. Its filament is made of a mixture of oxides which become conducting at a moderately high temperature. To heat the filament up to the requisite temperature a porcelain spiral is wound openly round it, and a fine platinum wire is closely wound round the porcelain. The current flows through the platinum wire and thus heats the filament of the lamp. As soon as the filament becomes hot enough the current begins to flow through it and works a cut out which breaks the platinum wire circuit. Another complication is that as the Nernst filament falls in resistance its temperature rises, and it has to be run in series with a special resistance. Thus although the Nernst lamp was far more economical than the carbon filament lamp, it was so complicated that it was never used extensively.

In 1905 the first metallic filament lamp appeared, the Osmium lamp. But it was not a great success chiefly because the filament is so brittle when cold.

The Osmium lamp was quickly followed by the tantalum lamp, brought out by Messrs. Siemens and Halshire. For the tantalum lamp the average consumption in watts per candle is 1.85 for direct current lamps and two watts for alternating lamps; that is, it consumes about half the energy of the carbon filament lamp.

The next advance came almost immediately. The tungsten lamp, called the Osram lamp, was brought out by the Welsbach Company. It consumes between 1.2 and 1.4 watts per candle, during a life of at least 1,500 hours. The economy of this lamp and its durability has led to its adoption in street lighting.

The arc lamp, used for outdoor lighting and for very large interiors has also been much improved. This lamp consists of an arc burning between two carbon rods. In the open arc it is enclosed in a glass globe to protect it from the wind, etc.; and in the closed arc it is enclosed in a fairly air-tight globe, carbonic acid is given off and fills the globe and the carbons burn more slowly. Thus, although the closed arc consumes more energy than the open arc (2.3 watts per candle against 1.4 to 1.1 watts per candle), the carbons last longer and the arc does not take so much trimming.

The first noteworthy improvement consisted in the invention of hollow carbons filled with some volatile substance which, vaporizing, lowered the resistance of the arc and steadied it.

The first satisfactory flame arc was made by Bremen, 1898-1900; improvements were made subsequently and now the flame carbon has a core from one-third to one-half the diameter of the carbon. This core consists of carbon, potassium silicate, and a fluoride; calcium fluoride gives a yellow flame and strontium fluoride a red one. The fluoride volatilizes and lowers the resistance of the arc, and thus makes it possible to work with a longer one, a great advantage in many ways.

The yellow flame arc consumes four and the white flame arc seven watts per candle. The flame arc is thus much more economical than the open or closed arcs, which consume 1.1 to 1.4 and 2.3 watts per candle respectively.

When comparing the cost of the arc lamp with the metallic filament lamp it is necessary to take into account the cost of the carbons and of maintenance for the arc lamp. The cost of maintenance varies considerably according to the location of the lamp, and in some cases, although consuming more energy, the tungsten lamp, which can now be made in large candle powers, can compare successfully with the flame arc. This is particularly true in street lighting, and is evidenced by the rapid increase of ornamental incandescent systems.

Street Lighting in New Zealand.

The development of important water-power enterprises in New Zealand deserves the attention of American manufacturers of hydraulic and electrical machinery, who, in case they desire to secure a share of the orders for supplies, equipment, etc., should get

into communication with Mr. Evan Parry, the newly appointed electrical engineer for public works. There should be an advantage to American manufacturers in the fact that these enterprises are to be carried out by the Government, for when the Government imports material, it pays no duty to itself; whereas, in the case of imports by private concerns the question of duty, and more especiall preferential duty in favor of British manufacturers, would have to be considered.

The demand for electricity in New Zealand for industrial purposes, such as for factories, mining, tramways, street lighting, and for domestic lighting, heating, and cooking is increasing constantly. The public has become so educated to electricity that the need for its cheap development by water power is well recognized by Government authorities, who now feel that, unless they are prepared to permit private capital to establish waterpower works, they can no longer refrain from committing themselves to the necessary expenditures and risks.

Electric street lighting is already fairly well developed in Wellington and Dunedin, 562,000 units being used last year in Wellington and 102,000 units in Dunedin. In Auckland one road has been successfully lighted with flame arc lamps, and no doubt the system will be extended to all the main thoroughfares. In Christchurch, street lighting by electricity has not yet been attempted, except for a few arc lamps maintained at the tramway stopping places. The minister of public works estimates that within the next five years owing to the introduction of cheap electric power, Wellington will have 190 miles of streets lighted with 220 electric arcs and 2,000 electric glow lamps; Auckland, 150 miles lighted with 200 electric arcs and 500 electric glow lamps; Christchurch, 170 miles lighted with 220 electric arcs and 400 electric glow lamps; and Dunedin, 180 miles lighted with 240 electric arcs and 600 electric glow lamps.

Ornamental Street Lighting.

Municipal pride and the desire to equal the achievements of neighboring cities has been responsible to a very great degree for the remarkable growth of the cause of better street lighting. Commercial clubs, civic organizations, and societies which have had the best interests of their cities in mind, have aided in securing even for the smaller cities, street lighting systems which, in addition to rendering their streets more beautiful, have a definte advertising value. Unlike most municipal improvements, ornamental street lighting has been developed simultaneously in the smaller and the larger cities. The application of the flaming arc, the Mazda, and tungsten lamps has revolutionized street lighting. These types have made possible lighting systems which are ornamental by day as well as by night.

The following is a brief account of some of the recent ornamental lighting installations:

Memphis, Tenn., is considering the question of replacing their unsightly wooden pole supported arc lights by the cluster system. Commissioner Dies has recently caused a number of ornamental steel poles supporting five light clusters, to be placed on various streets in order that the public may become acquainted with their superiority. The cost of the type of pole considered including installation is about $90. Commissioner Dies is seeking the co-operation of the property owners on the downtown streets with a view to immediate bettering of lighting conditions. This proposal was that if the property owners would agree to pay for the poles and cost of installation on the front foot basis, the city would keep the poles painted and supply current for their use.

Virginia, Minn., a city of 13,000 population has completed the installation of a tungsten cluster system, which was put in service on September 1st. The poles are of the five light pattern with 100-watt tungsten lamp, and are spaced eighty feet apart.

Pueblo, Colo., has installed a flaming arc system. The poles are placed 150 feet apart along each curb, giving a fairly uniform lighting along the entire street. The merchants contributed towards the installation.

Nashwauk, Minn., a town of only about 700 population has installed 22 iron lamp standards of the three light pattern. The central lamp is of the 60-watt size and the other two 40-watt. The central light is left burning throughout the night, while the other two are extinguished at 12 o'clock. The standards are placed 95 feet apart on both sides of the street.

St. Louis, Mo., has for some time been agitating the question of better street lighting. The street improvement association has, after a year's investigation of various street lighting units, recommended the use of the magnetite lamp. Broadway in St. Louis, with its three light standards supporting high power magnetite lamps, is an example of the type which they recommend.

Toledo, O., has its entire business section lighted by the magnetite lamps supported on two light ornamental standards. There are about 2,500 of these luminous are lamps in the business district.

St. Paul, Minn., has a five light ornamental lighting system in the downtown district which is enhanced on special occasions by the use of ornamental festoons, and by the decoration of the five light standards. A feature of the St. Paul instalaltion is the fact that the lamps are spaced uniformly, four on each side of the street to each block.

In Bloomington, Ill., a committee composed of Messrs. Frank Supple, John A. Beck, Frank Oberkoetter and C. C. Martens, who for some time have been engaged in the work of securing the subscription for the South

Main street cluster lights, announces that the list is now practically complete and the required amount of funds have been subcribed. According to the plans a total of twenty-eight lights wil be installed at a cost of approximately $2,600.

Ogden, Utah, has installed a cluster lighting system which is unique in several particulars. The posts are of the five lamp type, with four pendant, 60-watt and one erect 100-watt lamp. The posts are higher than it ih customary to use and are spaced 132 feet apart.

Pittsburg, Pa., has recently installed on Liberty avenue, a number of the larger size magnetite lamps. The arrangement is such that the lamps which are suported on either side of the street on 28-foot poles are spaced a distance of only 90 feet apart. The result secured is a powerful illumination over the entire surface of the street.

Council Bluff, Ia., has recently completed the installation of 5,000 candle power flaming arcs on Broadway. The effect secured is such that a shadow is cast in the brightest illuminated store windows by the light of the street lamps.

Chicago, Ill., is contemplating extensive lighting improvements throughout the city. A study of a practical light for Michigan boulevard has extended over a number of years. The South Park Commissioners have finally decided upon the use of the tungsten cluster lighting syhtem, and a very attractive standard supporting six pendant globes has been chosen. The lighting contemplated for other parts of the city is not to be of this type. The following statement from Wm. Carroll, city electrician, which appeared in answer to a question in a Chicago paper, will serve to give an idea of the policy which will govern lighting extensions in Chicago:

The plan for the instalaition of the 10,000 additional lights to be placed in service by the sanitary district for the city has been taken up with each alderman of each ward. The electrical engineer of the sanitary district and the city electrician, who are responsible for these plans, recognize the fact that underground wires are better and safer than overhead wires, but the additional cost of the street work for street lighting service makes underground wires practically prohibitive at the present time.

The plans for this street lighting extension contemplate using conduits for the trunk lines and overhead work for distribution, using 5-inch, 25-foot, steel poles and from one to two No. 6 weatherproof wires. This type of construction is not unsightly and is not much more dangerous than when the wires are placed underground. Over two years ago this department lighted the streets bounded by Calumet avenue, State street, Thirty-ninth street, and, Garfield boulevard in this way. There have been no complaints made by the citizens in this district of the unsightliness of the poles or overhead wires, and there have been no accidents in said district since the lights were installed.

It is not the intention of the city to force the overhead wires and poles on any neighborhood where the residents and property owners consider them objectionable. It is the intention, for the time being at least, to leave out streets or neighborhoods where the property owners strongly object to the overhead wires, and proceed with the lighting plans where they want the lights badly enough to be willing to accept the overhead wires. The city will place the circuits underground on any street or system of streets where the citizens or property owners on such streets are willing to pay the difference between the cost of the underground construction and the overhead construction.

The city's plan for the installation of these lights does not contemplate large wooden poles and a number of wires, such as the average citizen has in mind when he hears of overhead construction.

As to the statement that it is unwise to install arc lights when other progressive cities are taking out their arc lights, we believe that the lights which it is proposed to install are the latest thing in street lighing, and that arc lighting is the only practical street illumination. Many citizens appear to believe that under the contract with the sanitary district they are to get such street lights as the South Park Commissioners have installed on Michigan avenue between Randolph and Twelfth streets, or such as the Lincoln Park Commissioners have installed on Lincoln Park boulevard. It would cost the city to maintain this kind of street lighting throughout the city from $40,000,000 to $60,000,000 a year, this estimate being based on the cost of maintaining the south park lights per mile of street and the Lincoln Park boulevard lights per mile of street multiplied by the number of miles of streets in the city of Chicago.

The cost for maintaining the city's street lights during the year 1910 was as follows:

Gas lamps	$ 303,843
Gasoline lamps	188,546
Rented electric lights	67,395
Municipal electric lights	466,714
Gas office	16,903
Total cost for 1910	$1,043,401

The total appropriation for corporate purposes fund, not including amounts contingent upon bond issue for the year 1911, was $24,093,532, so that there can be no possible chance of the city's installing and maintaining street lights that will cost as much per mile of street as the Michigan avenue lights, the Lincoln Park boulevard lights, or the lights installed by commercial companies, at the expense of the property owners along business streets where special lighting is required.

Ornamental Street Lighting in Vancouver.

Vancouver, B. C., is using tungsten clusters. The lighting units on each street standard are shaded by sand-blasted instead of ground-glass globes. Each of the tandards is placed from 89 to 134 feet apart on both sides of the street and equipped with five 75-candle-power lamps. The top lamp is lighted throughout the whole night, while the other four are turned off at midnight. The standards are 14.5 feet from sidewalk to center globe and 10.5 feet to the lower globe. The diameter at the foot of the column is 7.25 inches, tapering to 5 inches. The distance between the two lower globes is 3 feet 3 inches. The base of the column is 1 foot 8 inches square.

The city council is arranging to provide for the maintenance of the lamps and the supply of the electrical energy, while the property owners will pay the first cost of the installation. The equipment as a whole

will cost the property owners from $2.10 to $2.65 per front foot, varying according to distance between posts.

The conduits are of steel and covered with a 2-inch plank, or of 2-inch hydraulic pressed fiber ducts laid in a 3-inch bed of concrete. All service and main conduit wires are on the three-wire system, lead encased cable with sheathing not less than 3-32 of an inch in thickness.

The concrete bases for the standards are 21 inches deep by 24 inches square, with 0.75-inch bolts, 24 inches long, embedded, to which the standards are firmly fastened.

Each standard is equipped with five 75-watt tungsten lamps, one 16-inch and four 12-inch spherically shaped globes, and in the base of each standard a transformer to reduce the voltage.

Municipal Power Plant Recommended for Los Angeles.

E. F. Scattergood, chief electrical engineer of the power bureau of the aqueduct, returned to Los Angeles recently after seven weeks spent in other places studying the more important hydro-electric power systems and the electric current distributing systems of the country. The report of Mr. Scattergood is briefly as follows:

The inspections of the more important hydro-electric power systems and distributing sytems of this country were made by Consulting Engineer Harris J. Ryan, Assistant Engineer T. A. Panter and myself with the result that we have secured much valuable data and information as to the good and bad qualities of the various types of machinery and equipment and methods of operation based on the experience of those in charge of these systems.

We saw a number of generating systems and I feel confident that the Los Angeles aqueduct power system will deliver power at a considerable lower generating cost than that for which it can be delivered to any other city in the United States excepting those in the vincinity of Niagara Falls.

Securng a low generating cost is, however, but a part of the fight to secure cheap rates to light and power consumers, which is the end to be sought and the only real basis for comparison.

Pasadena's municipal plant has a higher generating cost than that of the companies supplying Los Angeles, but can offer consumers lower rates than can be secured for the consumers of Los Angeles under present conditions. The generating cost at Niagara is still much lower, and yet the rates to consumers in the surrounding cities and towns are even higher than in Los Angeles at the present time.

With a complete municipal distributing system and an amount of business equal to that within the city for the year 1910, there could be established a 6-cent rate with a proportional scale for all classes of consumers, and, at the same time, experience a net profit, including interest on the investment and an allowance for depreciation and bond payments, of $700,000 annually. With the total business for the year 1913, excluding railway power, this annual net profit would be far in excess of $1,000,000 with the same 6-cent base, or the rate to consumers could be made proportionately less.

In that statement I have tried to strike a mean, giving both a reduced rate to the consumer and a large profit to the city for the benefit of the man who pays the taxes.

Concrete Ornamental Posts in California.

A new venture in municipal lighting is being made by Venice, Cal., with a concrete ornamental post, designed by City Engineer Lewis. Te city will manufacture them to sell to property owners at cost and furnish light free of direct charge. Molds made to order have been procured by the city and all preparations for producing the standards in municipal yards are complete. The post itself will cost $9. The total expense of setting up the concrete post, equipping it with electric light and connecting with conduit is placed at $15 each.

Such an innovation in ornamental lighting systems was first proposed by City Trustee Lorenz, formerly in the service of the Southern California Edison Company. A sample post, complete for service, is being exhibited.

Profit Sharing in Municipal Gas Plant.

For a period of five years the Stafford, England, municipal gas department has had in operation a system of profit sharing that appears to have proved satisfactory.

When the total cost of manufacture and distribution of gas is less than 20 cents per 1,000 cubic feet of gas sold, a bonus equal to one-fourth of the difference between that sum and the actual cost shall be divided among the workmen and clerks who have been employed in the department for not less than three months during the year in which the bonus has been earned. In any year where special charges, such as for main-laying operations, have been charged against revenues, the amount of same is to be deducted from the true manufacturing and distributing charges, in addition to the net cost of coal, rates and taxes, depreciation, and depreciation on cookers, etc., and consideration is also to be given to the profit and loss on gas fittings.

The following are the bonuses paid to the men during the past five years: 1906-7, 7½ per cent. on total wages paid; 1907-8, 9 per cent. on total wages paid; 1908-9, 9¼ per cent. on total wages paid; 1909-10, 9½ per cent on total wages paid; 1910-11, 10½ per cent. on total wages paid.

CURRENT · INFORMATION

Refuse Disposal in Berlin.—New York's Municipal Training School. — Motor Bus Transportation.— Engineering Exhibit at Baku.—Report on Paving Repairs in Chicago.—Los Angeles Refuse Disposal.—Street Signs in London.

Refuse Disposal in Berlin, Germany.

In a recent report of Consul General A. M. Thackara from Berlin, Germany, a short account of the garbage and refuse disposal system of that city is given. An abstract of this report is here noted.

The city administration supervises the cleaning of the streets, but the disposal of the sweepings and refuse gathered is left to various contractors. Some of these concerns have purchased barren and unproductive land to be used as dumping grounds, and as the refuse contains principally sand and horse manure, it is exceedingly valuable as a fertilizer and filler for such lands.

By law and by municipal police regulations, house owners are obliged to provide for the removal of the waste from their buildings. For this purpose they have formed an association that includes most of the owners in Berlin. This association has made a contract for 30 years, 21 of which are still to run, with a limited liability company, which was formed for the express purpose of disposing of household and other waste. They have erected a building for the purpose of handling the garbage, disinfecting it, and separating the different articles, such as metal, rags, and bones. All the refuse is then disposed of for fattening hogs, fertilizing, paper making, or for grading purposes, etc.

Ingeniously contrived wagons are used in collecting the garbage. In every building large sheet-iron tanks or buckets are placed. The daily refuse is thrown into these tanks, which are capable of holding 100 or 200 pounds of ashes and garbage, and which close with a lid. The ashes and garbage are placed in separate receptacles. On certain mornings of the week the tanks are collected by wagons accompanied by three or four men. These wagons are large and tightly covered. A chain elevator is arranged so that a bucket can be placed upon a shelf on the side of the wagon and then raised and dumped into the wagon without permitting any of the dust to escape.

Ash barrels or other such receptacles are not permitted on the streets in Berlin. The experiment of burning the organic waste of Berlin was tried, but it proved costly and unsuccessful and was given up.

New York's Municipal Training School.

A contribution of $80,000 from Mrs. E. H. Harriman, supplemented by some thirty smaller individual subscriptions by public-spirited citizens, among them John D. Rockefeller, Andrew Carnegie, Henry Phipps and J. P. Morgan, has made possible the establishment in New York of an experimental school for the study and administration of civic business in connection with the Bureau of Municipal Research of that city. It is announced that its scope is intended to be national.

The curriculum will embrace the analyzing of budget estimates and all public expenditures, the drafting of city charters, the study of health problems, the standardization of salaries, contracts and specifications, model municipal accounting, methods of assessing and collecting taxes, and the preparing of official statements for publication. The New York Bureau of Municipal Research is constantly receiving applications from similar organizations in other cities for qualified men to perform the same kind of work that is being done in the metropolis, but it has found it impossible to supply the demand. It is proposed that graduates of this new school shall fill these positions.

The line of training proposed in the New York school will include education for college graduates who may desire to go into the public service, accountants wishing to qualify for public business, superintendents for schools, secretaries for boards of trade or heads of civic organizations, and will offer advantages for post graduate students of politics, economics, sociology, law and other practical work that will fit them for public duties. The time is sure to come when all municipalities will look to the fitness of those who are selected for service the same as is done by corporations, and when that is done the best interests of the people will be conserved

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Motor Bus Transportation.

A new field for the motor truck and a convenient means of transportation is being developed, by the application of motor vehicles to passenger transportation. The private motor car for business and pleasure purposes,

and the bus lines maintained by the large city stores for the convenience of their patrons has been followed by the practical use of the motor bus as a passenger carrier, traveling on a schedule over a prescribed route.

The first example of this use of the motor vehicle was in New Haven, Conn., where a bus line was established on Orange and Grove streets. The character of Orange street, a principal residence thoroughfare, led to opposition to the attempts of the electric railway company in obtaining a franchise along the street. A horse-drawn bus line had been in operation for some years, when in 1909, S. A. Lewis conceived the idea of operating a motor bus line. Four buses were obtained and the line was put in operation, giving such satisfaction that two more cars have been added.

The following report of this bus line for the year 1910 indicates that it has proven remunerative:

Interest on original investment at 6 per cent	$ 930.00
Rent, light and heat	450.00
Wages	7,500.00
Depreciation at 15 per cent	2,325.00
Gasoline	1,980.00
Oil and Grease	128.00
Tires	466.66
Repairs	637.96
Total	$14,417.62
No. of buses	4
No. of round trips	40,800
No. of bus hours	19,200
No. of bus miles	163,200
No. of passengers carried	540,263
Total amount of 5-cent fares	$27,013.15

Leaving for total year's profit...$12,595.53 (which is 81.2 per cent on the investment.)

In the above figures, everything has been cared for except management and office expense. Up to the present, Mr. Lewis has looked after details in person, but with the increased equipment, the salaries of one or more assistants and office expense will have to be added.

The cars are the regular model R-14, manufactured by the Knox Automobile Co., Springfield, Mass., which is a two-ton carrier, with 40 horsepower four-cylinder engine. The wheelbase is 125 inches and maximum speed, 15 miles an hour. The body space is 10 feet long by 5 feet wide, but on later vehicles, it will be noted from the picture that the body is made longer and overhangs at the back. The front construction is such that the driver both operates the vehicle and controls the in-and-out movement of the passengers, thus dispensing with the necessity for a conductor.

With the exception of a short time when by reason of faulty street cleaning, the accumulated snow and ice prevented their operation, the cars have been run on a regular 10-minute schedule throughout the year. The class of traffic carried is practically the same as any street car operating through the residential section.

There has recently been installed in Meridian street in Indianapolis, Ind., a bus line which is similar in many respects to that operating on Orange street in New Haven. Meridian street is one of the most aristocratic residence streets of the city; in fact, the "Fifth Avenue" or "Michigan Boulevard" of Indianapolis. It is paved for practically its entire length with an eighty-foot roadway of wood blocks. The character of the street and the class of residences along it have made the construction of a Meridian Street car line undesirable.

These features coupled with the fact that one of the nearest electric car lines extends only to Twenty-second street, while Meridian street is thickly built up past Thirty-fourth street; and the other operates so as to be crowded at all hours of the day, led to the idea of the motor bus line.

A company was organized, of which James T. Eaglesfield is president; and seven motor buses were purchased from the White Company, of Cleveland, O. A garage, perhaps more properly a car barn, was constructed, having space and repair facilities for eight or ten cars, with ample and safe provision for the storage of oil and gasoline.

The cars are of special body construction, though the truck is the ordinary 1½-ton commercial truck, manufactured by the White Company. The engine is of four cylinders. 30 horsepower, water cooled; and is connected to the shaft drive through a leather

THE KNOX MOTOR BUS IN NEW HAVEN.

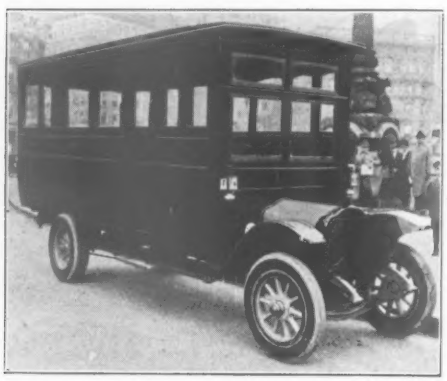
faced cone clutch, a four-speed transmission being provided. An extra long, 144-inch, wheel base provides against the excessive jar or vibration common to a short wheel base. Special spring construction, and the so-called "Sewell" cushion wheel are other features which cooperate to lessen the vibration. The "Sewell" wheel is a feature worthy of note. It consists essentially of an outer hard rubber tire set upon, and separated from an inner hard rubber rim by a series of ⅜-inch rubber cylinders which are placed transversely to the two tires, or better, the tire and the rubber rim. An outer and inner rubber flange hold the cylinders in place; and the result obtained is a great improvement over the hard rubber steel-rimmed tires.

The body construction, with the two long

seats along either side, allows seating capacity for 18 persons, and in case of necessity standing room may be had for 10, giving a total capacity for 28 persons. The driver, who is also the conductor, is seated near the forward entrance, where a "pay-as-you-enter" fare register is provided. A rear door and automatically operated drop step are provided for egress only. The cars are heated by a system of coils through which the hot waste gases from the motor are conducted; while the current for the electric head and tail lamps is provided from storage batteries.

The cars have been operated for about one month, and have proven very satisfactory in that time. With six years in operation and one held in reserve, 23 round trips are made per car each day, operating on a 7-minute schedule. The route is about 3.4 miles in length and extends from the Monument Circle to Thirty-fourth street. Stops are made on the "near side" to take on and discharge passengers, and as the line operates only to the edge of the downtown district, little trouble is experienced due to traffic congestion.

Since the start a steady growth has been noted in the number of passengers carried. This has been particularly true of the class of traffic carried to and from theaters and



THE WHITE MOTOR BUS IN INDIANAPOLIS.

to the downtown district for shopping purposes. No figures of cost are available at this time and the only statement obtainable regarding the volume of business, shows an average daily traffic of about 1,400 passengers. The fare charged is 10 cents for a single ride, 10 tickets for 50 cents and 21 tickets for one dollar.

So far as is known the two examples noted are the only motor bus lines operated in the United States as commercial pessenger carriers. Chicago has at present a number of gasoline motor buses running between the great department stores on State street and one of the railroad depots. Other concerns also have approached the Chicago Motor Transfer Company with a view to obtaining motor bus service from their establishments to the downtown shopping districts and various other strategetic points. Among these are the Chicago Athletic Association, the University of Chicago, the Blackstone hotel, and the Aurora, Elgin & Chicago railway. The lines operated in New Haven and in Indianapolis differ in the fact that they are on a purely commercial basis, similar in most features to the electric street railway line.

Engineering Exhibition at Baku.

The Baku branch of the Imperial Russian Technical Society has perfected plans for holding an international engineering exhibition at Baku, Russia, next April, which will be under the special patronage of the viceroy of the Caucasus.

Among the chief exhibits will be electrical motors, internal-combustion engines, air compressors and other equipment for oil-field development, while a special section will be devoted to motor cars, which, both for purpose of pleasure and business, are finding great favor in southern Russia. With a view to inducing English manufacturers to participate in the exhibition, reduced railway charges from Batum to Baku have been arranged for the exhibits, while after the close they will be returned free of all freight to Batum, from which port there are regular sailings to England. Another important concession to English exhibitors is that no duty has to be paid upon the exhibition goods entering Russia. The exhibition will remain open for six weeks. Dr. P. Dvorkovitz has been appointed the official honorary representative of the exhibition in England, and he will give full particulars to all inquirers at 1 Broadstreet Place, E. C., London.

Repairing Asphalt Pavement in Chicago.

The Bureau of Public Efficiency of Chicago has recently issued a report covering the asphalt pavement repairing done under the 1911 contract. Bids were requested on May 6, 1911, for repairing aproximately 100,000 sq. yds. of asphalt pavement. The specifications fixed a price of $7 per cubic yard for concrete and $5 per ton for binder, and a minimum charge of $10 for the repair of any opening was made. Four companies bid on the work, and the contract was awarded to the American Asphalt Paving Company at 59 cents per sq. yd.

Some dissatisfaction is expressed in the bureau report, both as to the scope of the repair work and as to the method followed in doing the work. Specific instances of faulty construction are cited in the criticism offered. The following are some of the defects noted:

Specific instances were noted by bureau investigators in which the cutting out of the

pavement extended from 6 in. to 2 ft. beyond the lines laid down by the inspector for the city. Other instances are given, in which the contractor removed portions of this pavement between patches, with no obvious reason.

In removing defective pavement it was the custom to lift it with picks or bars and break it off with the cutter. This caused the pavement in many places to be lifted beyond the line marked by the inspector, and destroyed the bond between the binder and the concrete base.

The specifications required that the binder be brought upon the street at a temperature of from 200 degrees F. to 225 degrees F. Instances were noted where the binder as delivered on the street it could be picked up and handled with the bare hands. On June 13 a load of binder was used on North Clark street, which arrived on the work too cold to shovel from the wagon, and the rake and shovel were used in pulling it out from below the wagon.

The thickness of the top coat of repairs was measured at 370 places on the West Side. The thickness specified was 1½ in. Twelve measurements were more than 1½ in.; twenty-seven measurements gave a thickness of 1½ in., as required under the contract; 331 measurements were less than 1½ in. and averaged 1 1/64 in.; 167, or a little over 50 per cent., were of 1 in. or less. Correspondingly irregular measurements were shown on the North and South Side work.

Specifications required that the wearing surface should be dumped at such distance from the work that all of the mixture should be turned and distributed to the place where it was to be raked. Inspection by bureau investigators showed that the wearing surface was shoveled from the wagon to a point as near as possible to where it was to be used.

The reason assigned for these irregularities is given by the bureau as lack of effective inspection. It was noted that in most all cases there were enough local and general inspectors on the street to give adequate supervision and inspection to the construction in progress. That the inspection was, however, inefficient was evidenced by the great number of instances of non-compliance with the specifications which were noted during the investigation.

In view of the situation discussed above, the bureau submits the following recommendations and conclusions in respect to specifications for asphalt repair work and in regard to the inspection of the work done under the contract.

I. Specifications—

1. Specifications for asphalt repairs should be so changed as to provide either for one competitive bid on binder per ton, concrete per cu. yd. and surface mixture per ton.

2. The city should fix in the contract a lower rate than $5 per ton for binder and $7 per cu. yd. for the concrete.

3. The contract should be so changed as to give to citizens the same rate for repairs as is given the city.

II. Enforcement of Contract Provisions—

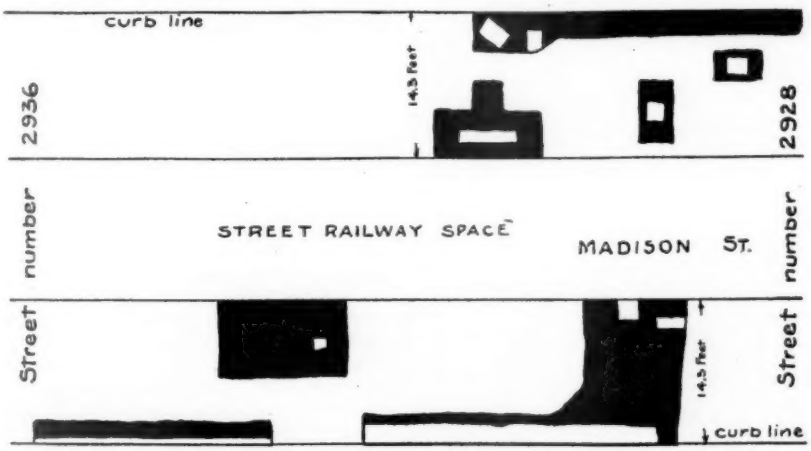
Work done under the specifications is defective in the following particulars:

1. Larger areas of pavement are removed than is necessary.

2. The pavement is damaged by careless methods of cutting out the defective pavement.

3. Often the binder lacks the stone specified in the contract, is laid cold and is not promptly covered with wearing surface.

4. The thickness of the wearing surface is in many instances below the 1½-in. requirement of the contract.



MADISON STREET REPAIRS. WHITE SPACES SHOW PORTION REPAIRED; BLACK, THAT WHICH SHOULD HAVE BEEN REPLACED.

5. The method of mixing, raking and rolling the wearing surface is frequently inadequate to the specified requirements of the contract.

III. Records—

In order to test the life of the original pavement and repairs a complete street map showing the exact location and time of repairs should be kept. These records, properly kept and analyzied would be valuable in determining at what time the repairs should cease and when the roadway should be resurfaced.

IV. Municipal Asphalt Paving Repair Plant.

In view of the difficulty experienced in securing full value for the wheel tax fund expended in street repairs, the bureau suggests that the city consider seriously whether the work of asphalt paving repair might not be more economically performed by the city itself.

The accompanying figure gives a comparison of the amount of repair work which has been done and that which is estimated by the Bureau of Public Efficiency engineers to be necessary.

Los Angeles' Refuse Disposal.

Los Angeles' garbage at the present time amounts to about 175 tons daily. This is collected from cans set out on the edge of the curb and is transported by the V. D. Reduction company and fed to 12,000 hogs. The hogs thrive upon the food, and when they attain a marketable size are brought to the city and sold.

The city's garbage is a constantly growing quantity. At the present time it is enough to feed between 15,000 and 20,000 hogs.

The city pays $4,000 a month to have the garbage removed and seems satisfied with the agreement; the contractors who feed the garbage they collect are pleased with the plan, for they are making money from the pork. But aside from the mere financial bargain, the city officials and the public have shown their dissatisfaction with the present plan and other methods of disposing of the garbage can's contents are being seriously discussed.

Most cities have disposed of the garbage question by the erection of a reduction plant, or incinerator, although coast and river cities find dumping in the stream a satisfactory and cheap method. New Haven, Conn., has tried the hog-feeding system, but found itself with a bill of $40,000 on its hands for "care of the pigs" after three months.

Collections are made from hotels daily. From the lodging house district they are made three times a week, while the residence district has to be content with two collections weekly. For this work, the V. D. Reduction company is paid $48,000 a year. There is under consideration now a plan of having hotel collections made from the premises instead of from adjacent pavements, the apartment houses given six calls weekly, and residence sections three instead of two. According to figures submitted, the additional cost would be $33,500 a year.

It is probable that the growing dissatisfaction with the present method of disposal will lead to the adoption of other measures.

Street Signs in London.

A recent issue of the Surveying and Housing World states that the Royal Institute of British Architects is calling attention to the importance, both in an aesthetoc sense and as a matter of public convenience, of steps being taken by the Borough Councils of London towards the provision of name tablets for the corners of streets with well-designed letters preferably of a uniform style throughout the metropolis. Whilst in Paris every street corner bears the name of a street, in London there are hundreds of corners where no names are to be found, so that it is often difficult to discover the name of a street without inquiring or walking some distance along it.

In regard to the aesthetic question, the Institute suggested that a good type of letering should be adopted on two scales, the larger or maller scale to be adopted according to the width and importance of the street and the architectural scale of the buildings flanking it. The Institute also expresses the opinion that one of the faults of the present condition of affairs is that not only are name tablets wanting in many situations, but that those which exist are in so many different forms and patterns, and, in stating that they do not advocate the employment of any tablet more costly than those now in use, they suggest that if the Borough Councils are willing to consult together on the subject and to take up the matter and agree upon a pattern of lettering, uniformity for the whole of London could be secured to the great advantage of the appearance of the streets and general convenience of the public.

Cincinnati's Municipal Laundry.

Cincinnati has recently opened a municipal domestic laundry where poor women of the tenement districts may take the family clothing and do their own washing with the aid of the most up-to-date machinery. The equipment of this laundry includes enough power washers, driers and electric irons, to accommodate 500 family washings each week, and the city is preparing to build more laundries of like nature. The idea originated with the board of health, which was quick to recognize the sanitary advantages derived from removing clothes-washing operations from the living and sleeping rooms of the tenement dwellers.

MUNICIPAL AND TECHNICAL LITERATURE.

Books for Engineers.

Books for Engineers.

Good Engineering Literature: What to read and how to write with suggestive information on allied topics. By Harwood Frost, M. Am. Soc. M. E., M. Soc. Prom. Eng. Educ., etc. Cloth, 420 pp., $1 net. Published by the author. Chicago Book Co. agents, 226 S. LaSalle St., Chicago, Ill.

The above title is correct with one exception, viz.: that the book devotes very little space to what to read, but is given up almost exclusively to instructions on how to write and how to make a book. In this field it is unique, and takes the same place that several hand books published by large publishing houses do in the general literary field.

The earlier chapters are on literary expression and the need to the engineers of correctness and facility therein, rhetoric and grammar, orthography and punctuation. words and phrases. In the latter chapter the ambiguity and the inaccuracy in the use of numerous engineering phrases is clearly shown, as well as the necessity for greater precision.

Inspiration and motive in literary work, essentials to success in literature, what to write about, collecting and arranging material, are general subjects which the author treats with special reference to the preparation of engineering literature with much good advice. Exercising the memory is a subject interjected which receives very unsatisfactory treatment.

The preparation of manuscripts for publication, mainly the manual labor of the process, which he terms editing the manuscript, is gone through in great detail and is thoroughly well done. This chapter can not of course include the real process of editing a manuscript which requires revision or trimming or amplificaton to suit the requirements of space, or of the purpose of the editor or of the publication in which it is to appear. This is the art which cannot be acquired by instruction but only by practice and study. The conditions which circumscribe this editing process are indicated in the chapter on the field and policy of technical publications, with a special chapter on the write-up article and some instructions to authors issued by technical publications.

The rights of an author in his works are clearly defined, with the methods of protecting them by copyright, by contract between author and publisher, by laws regarding libels.

The processes of preparing illustrations for reproduction are briefly described with suggestions of special points to be observed.

The making of the book after the type is set and the cuts for illustrations are made is clearly described with many practical pointers regarding paper and binding, followed by a detailed description of the principal styles of type used in book making and the standard methods of marking errors in proofreading. The rules for making up a periodical are given as an example of the matters to be considered in determining upon the details which make up the style of the publication, whether book or periodical.

Indexing and filing books, trade publications, articles from periodicals, etc., are subjects concerning which the main principles of modern libraries are given.

The principles of criticism to be applied to the completed book are detailed as followed by the author and will be of assistance to a reader desiring to judge a book of which he is considering the purchase, whether from reviews which he may read or from a brief examination of the book itself.

One excellent chapter is that on the engineer's library and the method of selection of books and periodicals for it.

The book closes with a list of the technical indexes of articles in periodicals which are published in the United States.

If every engineer would familiarize himself with the principles laid down in this book and would apply them to his own reading and writing the engineering profession would vastly improve its standing in the estimation of the general public. In the past the engineer's education in English, in expression of his thoughts and his knowledge in forms to be understood by others was neglected and is none too thorough at the present time. His daily work is usually such that it gives him no opportunity to improve himself in this regard without spurring himself to it, something which he soon loses incentive to do unless he receives encouragement in what little he may attempt to do. Ordinarily such attempts are not so well expended that they receive the attention from readers that they deserve so that the budding author is soon discouraged. A careful study

of this book will show him where his faults lie and will give him much valuable aid in finding out how to overcome them.

Graphical Solution of Storm Sewer Problems, collected and arranged for use in the designs of permanent drainage systems. By Charles Cottingham, C. E. Three large blueprint sheets in flexible covers, $6. Published by the author, Danville, Ill.

In this publication the compiler presents in convenient form the diagrams and tables used in designing storm drainage systems by successful engineers, in such manner that results derived from their use can be easily compared.

Side by side at one end of the first sheet are diagrams for large sewers platted for Foss's formula and for Kutters' formula with n equal to 0.015, which show the usual tendency of the latter to give smaller sizes of sewers than other formulae with velocities less than 4 feet per second and larger sizes with higher velocities. These diagrams would be easier to compare if they were lettered and lines were numbered exactly alike.

The second section of this sheet gives some observations of velocities at various depths and distances from shore in open channels 4 or 5 feet deep and 18 or 20 feet wide and in arched channels of some 6 feet width and 3 to 5 feet depth running full or some 0.9 full. Scale is not given on these diagrams but the results are computed on the diagrams. It gives also rates of maximum rainfall at the University of Illinois from March, 1908, to July, 1909; and a diagram assuming that the proportion of rainfall reaching sewers varies directly as the population for 0 to 50 people per acre, with no data on which such an assumption might be based. There is also a small diagram showing the diminution in rate of increase in population as the population increases from 10,000 to 190,000; presumably the percentage of increase per annum, but the scale does not include this information nor a reference to data on which it is based.

The third section gives curves showing the relation between proportional wetted perimeter, area, hydraulic radius and proportional depth for circular and for egg-shaped sewers; and also the relation between proportional velocity, depth and discharge for sewers full, and full to various proportional parts of the full depth, also for both circular and egg-shaped sewers. There is also a diagram for correcting sewer discharges for changes in value of n in Kutter's formula. A diagram gives the cubic yards per linear foot for trenches of various widths and depths with vertical sides and two others for trenches with sides with various slopes from ½ to 1 to 4 to 1.

On the second sheet is a large diagram of capacities of sewers from 2x3 feet to 15x20 feet, presumably computed by Kutter's formula, though not so stated, and two diagrams of volumes reaching sewers from areas of various acreage from 0 to 10,000 by the Burkli-Ziegler formula with assumed constants of population, rainfall, character and slope of surface.

There are also small diagrams showing the data used in the various boroughs of New York and the formulae and constants assumed in accordance therewith and one showing the average price for pipe sewers laid in Ohio, Indiana, and Michigan in 1908 for various depths of trench and sizes of sewer from 6-inch to 24-inch diameter.

The third sheet gives the diagram showing the volume reaching the sewers used in Indianapolis, based on a modified Burkli-Ziegler formula; also for smaller areas, 0 to 3,500 acres, the storm water run off by the original Burkli-Ziegler formula for assumed constant and rainfall and corrections for other values thereof, one set being specially for country towns. There is also another diagram of relations between depth, velocity and discharge in circular and egg-shaped sewers running full and various fractions of full.

A number of small diagrams and tables which have appeared in MUNICIPAL ENGINEERING are reproduced to show the number of brick in various sized sewers, the mortar required for laying the brick, the amount of each material required for laying egg-shaped and circular brick sewers of various sizes. There are also two more diagrams showing cost of sewer work under definite specifications and one for estimating cost of manholes.

The engineer engaged in sewer work, particularly in designing storm sewers, should find the diagrams very convenient. They certainly are to the writer of this review.

The Merchant's and Seaman's Expeditious Measurer; containing a set of tables which show at one view the solid contents of all kinds of packages and casks according to their several lengths, breadths and depths; also rules for determining the contents of all sorts of casks in wine and beer measure. Sheep, 196 pp. A. L. Nash, New York.

The tables give directly contents of rectangular volumes for depths or least dimensions from one inch to four feet and for each such depth, breadths and lengths for each inch increase from the minimum, which is the same as the depth or least dimension to the maximum, which is 13 inches greater than the minimum for breadths and 5 feet 11 inches greater for lengths.

The volume of casks is given in an inserted column headed "5ths off C.," the use of which is fully explained.

Surface measurements can be taken from the pages for depth of one foot.

The Width and Arrangement of Streets; a Study in Town Planning. By Charles Mulford Robinson. Cloth, 199 pp. $2 net. The Engineering News Publishing Co., New York.

The author has had some years of experience in studying towns with a view to improving their appearance by changes in, additions to and ornamentation of their plans

and in recommending general plans for additions to existing cities. He is therefore well qualified by experience to speak of the difficulties met and to show the methods that have been used for overcoming them. He is not an engineer and his work lacks some things which that sort of education might have given him, but, on the other hand, he has escaped some of the bonds which engineers are liable to find themselves entangled in. The present volume is very closely confined to the brand of the great subject of town planning which is covered by the title, and he has covered this part of the field very completely. Occasionally there are some sentences and paragraphs which are difficult of understanding, partly, perhaps, because they were not written carefully enough, but partly because of a certain indefiniteness in the meaning of the words used; thus, in most of the book the word "street" seems to be used for the roadway. not including walks and lawns, but at times it apparently means the whole area between property lines. The engineer is accustomed to the latter use and to dividing the street into sidewalks, lawns, roadways, tracks, etc., so that he must be careful to get himself into the author's use of the word before he can be quite sure of his meaning.

The first chapter gives a good general layout of the subject of the book, showing the necessity of more careful division of streets into business, major and minor and strictly residence streets, through lines and subordinate lines and strictly neighborhood streets. The unwisdom of street adherence to standards of width and of division of street area is well shown. The relations of street width to housing and to land values for thickly settled areas and more open areas are outlined briefly, and there is a timely chapter on how to lessen the cost of improving wide streets. Main traffic streets are treated in their relations to transportation to and from business and residence districts and the surrounding country. And the need of a provision for central control of the platting and changing of streets is well shown. The best part of the book is devoted to the platting of minor residence streets in high-class districts, the development of high-class minor streets and of minor treets for small houses, and of public reservations other than streets. A good point made in the last chapter is the close connection which these reservations have with the streets coming to them and with the general street plan, and the consequent necessity, if the best service is to be secured, of considering parks, boulevards and squares at the ame time that the street plans are made.

Ten years or even five years ago this book would have been considered as highly academic, but the advances have been so rapid toward the improvement of city plans that it is treating what is now an eminently practical subject, and it should serve efficiently in arousing still stronger sentiment in favor of better plans for new urban districts and improvements in the old plans whenever changes in them are at all possible.

Bids for Garbage Plant at Paterson, N. J.

Bids for garbage and refuse disposal plant have been received at Paterson, N. J., from five sources, three presenting English destructors, including the Horsfall, Heenan-Froude and Sterling, one an American incinerator, the Decarie, and one a reduction plant. The first three provide for disposal of all refuse, the fourth omits ashes, and the last includes only garbage. The capacity used in computations of comparisons is 18,000 tons a year.

The interesting feature is the comparatively slight range in cost of plants and operation. Taking the most modern method of computation and adding together the cost of operation and of repairs, and 10 per cent. of the bid price of the plant, the highest bids of the first four bidders, omitting the reduction plant, range between $14,775 for the Decarie incinerator and $18,150 for the Horsfall destructor. Three companies submitted alternative bids, and the lowest of all was the Heenan-Froude, at $14,050, although the first cost of this plant, $81,000, is the highest, except the Horsfall, $89,500, and the reduction plant, $89,893. Wm. F. Morse, of New York, is the consulting engineer.

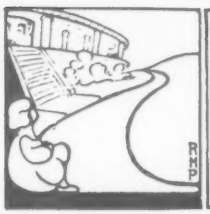
Oklahoma City Water Works Problem Settled.

At a special meeting of the board of city commissioners on November 18, the Western Wells Company, of Kiowa, Kans., was awarded the contract to furnish Oklahoma City 5,000,000 gallons of water per day at 2 cents per 1,000 gallons, with certain provisions inserted to protect the city from any loss in case there is a failure to carry out the terms of the contract, or failure in finding a sufficient water supply. The contract has been drawn by the municipal counselor's office and is ready for the signature of representatives of the company.

However, the fact that the contract was not signed has not delayed the work of the company. For two weeks it has been making the necessary tests, and machinery to complete the work has been shipped to Oklahoma City. There has been no delay, according to Commissioner Hampton, in starting the actual work of sinking the wells.

Moscow's City Pawnshop.

Fifteen years ago Moscow started a city pawnshop. Since then it has lent more than $27,000,000 on nearly 7,000,000 articles left in pawn.



ORGANIZATIONS & INDIVIDUALS

The American Association for Highway Improvement.—The American Road Builders' Convention.—The American Civic Association.—The Association for Standardizing Paving Specifications.—Calendar of Technical Meetings.—Technical Schools.—Technical Associations.—Personal Notes.

The American Association for Highway Improvement.

The first convention and good roads congress of the American Association for Highway Improvement opened with a large audience on Monday morning, November 20, and nearly five hundred registered during the day, with many in attendance who did not register. Governor Mann, of Virginia, and Mayor Richardson, of Richmond, welcomed the convention and were followed by Logan Waller Page, the president of the association, who gave a brief history of the movement resulting in the organization and the convention. He introduced Senator Martin, of Virginia, who is a strong advocate of national aid for good roads. President W. W. Finley, of the Southern railway, discussed good roads and the farmer, and J. Hampton Moore, of Pennsylvania, endorsed national aid and a Lincoln memorial highway from Gettysburg to Richmond by way of Washington.

In accord with the preceding speeches by members of Congress, Cyrus Kehr, of Knoxville, Tenn., introduced a resolution recommending the appropriation of $50,000,000 a year by the United States government for highway improvements, which was referred to the committee on resolutions.

At the afternoon session the Secretary of Agriculture presented an address, representing also the President, who was unable to be present owing to his illness. Gen. T. Coleman Du Pont described in considerable detail his plans for a great highway in Delaware, with a right-of-way 200 feet wide, and his uses for this great width. Much of it he would lease for at least a few years for cultivation, using the proceeds for maintenance of the roadway. Dr. Walter H. Page, of New York, made a few excellent points in favor of good roads, and the program was completed by an address by Senator Swanson, of Virginia, who made an eloquent appeal for support of his bill providing for an annual appropriation by Congress for good roads, and explained its provisions.

The evening was given to an entertainment by the Chamber of Commerce and the City of Richmond.

The program of the last two days was practically as follows:

Chairman's Address, by Harold Parker, formerly Chairman of Massachusetts Highway Commission.

"Macadam and Gravel Roads," by Hon. W. C. McLean, Provincial Engineer of Ontario, Toronto, Canada.

"Sand-clay and Earth Roads," by Capt. P. St. Julien Wilson, State Highway Commissioner of Virginia.

"Bituminous Roads," by Major W. W. Crosby, State Highway Engineer of Maryland.

"Brick and other Road Materials," discussion opened by Prof. Edward Orton, Dean of Engineering Department, Ohio State University.

"Road Cost and Maintenance," by Arthur H. Blanchard, Professor of Highway Engineering, Columbia University.

Address by Onward Bates, Past President of American Society of Civil Engineers.

Address by Capt. D. L. Hough, President, United Engineering and Contracting Company, and others.

Discussion: The Relation of the Road Contractor to the Engineer.

"Highway Bridges," by A. N. Johnson, State Highway Engineer of Illinois. (Illustrated.)

Address by Nelson P. Lewis, Chief Engineer of the Board of Estimates and Apportionment of New York City.

Address by J. B. Girand, Territorial Engineer of Arizona.

"Traffic Rules and Regulations," by Major Ricard Sylvester, of Washington; President International Police Association; Superintendent, Metropolitan Police, District of Columbia.

"Motor Vehicle Law of Massachusetts," by Col. William D. Sohier, of Boston.

"Review of the Automobile Industry—What it has done for Good Roads," by Col.

Charles Clifton, of Buffalo; President, Automobile Board of Trade.

"A Model State Motor Vehicle Law," by Hon. Edward Lazansky, Secretary of State of New York.

"The Motor Vehicle Law of Connecticut," by Hon. Matthew S. Rogers, Secretary of State of Connecticut.

"Forecast of the Automobile Industry," by Hugh Chalmers, Detroit.

"The Rights of Road Users in America Learned from Europe's Lessons," by Davir Beecroft, Chicago.

"The Illinois Motor Vehicle Law," by Sidney S. Gorham, Chicago.

"Quebec-Miami Highway Project," by H. D. Hadley, Chairman, McDonough Club, Plattsburgh, N. C.

"Use of Convict Labor in Road Building," by Dr. Joseph Hyde Pratt, State Geologist of North Carolina; Dr. S. W. McCallie, State Geologist of Georgia; Hon. Charles T. Lassiter, of Virginia, and others.

The feature of Wednesday was the report of the committee on resolutions of the congress, which read as follows:

Whereas, it has been the policy of our central government to aid in the development of our national resources, and to this end it has appropriated, and is appropriating public funds to meet the needs of the postal service, of agriculture and commerce, and of public defense;

Therefore, be it resolved, That this congress hereby respectfully memorializes the Congress of the United States to extend national aid to the several states of the union for the purpose of aiding and encouraging them to build and maintain good roads.

And that the chairman of this congress appoint a committee on national highway legislation, to be composed of one member and alternate for each state and territory, said member to be named by the delegation from that state at this congress; and that said committee request the co-operation of similar committees of all other organizations to assist them to harmonize the diversified opinions of the various interests now working for national aid, and endeavor to establish an agreement upon a united plan that may receive the endorsement and support of this association, and all others working for the establishment of the principle of national aid in the policies of our government.

Whereas, the highest degree of efficiency in road construction yet employed still leaves the question of maintenance the most important and serious question in the road problem, and

Whereas, this question of maintenance of public roads has not been given the careful consideration that it deserves, therefore,

Be it resolved, That this congress most earnestly urges upon all road authorities their immediate, continuous and careful attention to this most important subject; and that no appropriation or construction should ever be made without proper provision for their after maintenance.

Whereas, a large number of the states have made special appropriations for assisting the counties in building roads, and are constructing and maintaining these roads through a state highway department, and that this method has been found the most efficient to give a state a good system or roads;

Be it resolved, That we recommend to the various states not already provided therewith, the adoption of legislation, providing for state supervision of at least the main highways of the state, through a state highway department, and for state aid in the building and maintenance of such roads, by the making of liberal appropriations, raised by direct taxation or the issuance of bonds, as the best plan yet devised to promote and secure an efficient system of highways for a state, and at the same time uniformity in road legislation between the various states.

Resolved, It is to the opinion of this congress, that in order to secure desired results in road work most quickly and most efficiency, the work of both construction and maintenance of all public highways of any locality or state should be under the direction of experienced highway engineers, and that such engineers should be given all the authority necessary to justify holding them fully responsible for the results of the work.

Resolved, That this congress emphatically recommends the enactment of proper laws by all the states providing for the employment of prison labor in the improvement of the public highways.

Resolved, That this congress heartily commends the work of the department of agriculture for the betterment of the public roads of this country.

Representatives of this association and of the Road Builders and the Road Material and Machinery associations met to consider co-operation in holding conventions, and recommended the plan to their respective directorates and asked for the appointment of a committee of two from each organization to work out the details of the plan.

On the last day, after the adjournment of the congress, the American Association for Highway Improvement held a meeting and adopted a constitution and by-laws and elected as officers Logan Waller Page, president; W. C. Brown, vice-president; Lee McClung, treasurer; J. E. Pennybacker, Jr., secretary; C. P. Light, organizer; also, eight directors for three years, eight for two and seven for one.

About 750 delegates were registered at the congress, and about 100 members were present at the organization of the association.

American Road Builders' Convention.

The convention held by the American Road Builders' Association at Rochester, N. Y., November 14 to 17, was almost as large as that of the previous year, about 1,400 being registered. As usual, the attendance was largely from the state in which the convention was held, but there was considerable representation from widely separated states, as far away as California. The program was a good one, but the discussions almost always turned to the problems of New York roads.

On the first day after the usual addresses of welcome and responses, there were addresses on road subjects by Samuel Hill, former president of the Washington Good Roads Association; N. J. Bachelder, master of the National Grange, and Robert P. Hooper, president of the American Automobile Association. J. A. Bensel, state engineer of New York, discussed the problems of highway administration, and was followed by Geo. W. Cooley, state engineer of Minnesota, and Harold Parker, chairman of the Massachusetts Highway Commission.

On the second day, Nelson P. Lewis read a paper on the adaptability of roads and pavements to local conditions, a part of which is given elsewhere in this issue.

In the discussion of this paper, W. A. McLean, of Toronto, emphasized the desirability of holding the engineer to his duty to select the kind of pavement best for the street or road and not leaving it to the decision of the inexpert property owners; the effects of climate upon construction and selection of materials from the sub-soil drainage, which is most important in a cold, moist climate than in a dry climate or one with little frost, to the quality of the bituminous material used for treating the wearing surface, the effect of local supplies of material upon prices and consequently upon the economy of their use; the necessity of good grading, drainage, surfacing, and maintenance of the 90 or 95 per cent. of roads not in the first class, that the ease of feeding to the well improved roads of heavy travel may be commensurate with the ease of use of those first class roads, and at the same time keeping down the cost by not adopting more expensive methods of improvement than the traffic justifies.

This was followed by a paper by W. W. Crosby, state highway engineer of Maryland, on "Road Construction," which will also be found elsewhere in this number. Robert A. Meeker, state supervisor of New Jersey highways, in his discussion of the paper, noted the primary necessity of attention to setting slope stake and the stakes for cuts and fills before beginning the work of moving the earth. He recommended beginning excavations at the edges of the cuts at the location of the deepest cuts and filling first at the outside edge so that all parts of the fill will get the full compacting effect of the compression by the teams hauling the dirt. Stumps may be left in a fill in low ground if they will always be below the water level. Most New Jersey roads require special attention to drainage and unglazed, porous tile, 4 and 6-inch diameters, are used with open joints and pervious material in back fill, such as cinders, gravel, crushed stone, oyster shells. Many times the reconstruction of an old macadam road is not justified unless grades are reduced and flats are drained and these points are therefore emphasized. Failures in surface applications of bitumen result from lack of homogeneity in the road surface, the bitumen almost disappearing where voids are large and remaining near the surface where the structure is close. Charles Ross brings the surface to more uniform density by grouting with cement mortar; Harold Parker by letting travel run on the road for some time before applying the bitumen.

Charles Ross, street commissioner, Newton, Mass., also discussed the paper, laying stress on taking care of surface water and proper treatment of cuts in the surface. There was quite an animated discussion from the floor, showing the great diversity of practice and the desirability was expressed for still further discussion, preferably of specifications formulated by experts, that practice may be unified as much as possible.

Joseph W. Hunter, assistant commissioner of highways of Pennsylvania, presented an excellent resume of the highway laws of that state, which is abstracted on another page of this issue.

On the third day the problems of the contractors were discussed by C. A. Crane, secretary of the General Contractors' Association; F. E. Ellis, of Melrose, Mass., and E. F. VanHoesen, secretary of the Norfolk Road Builders' Association Mr. Crane criticized the law requiring that no alien labor be employed, because there is not enough native labor to supply the demand, and that requiring the payment of the current rate of wages, because there is no way of determining this. He also objected to the small salaries paid the engineering employes of the state because they were not sufficient to insure the best men. At the night session three illustrated papers were presented, by Prof. A. H. Blanchard, of Columbia University, on European roads; by Paul D. Sargent, of the United States office of Public Roads, on roads in the United States, and the chief of the bureau of town roads in New York showed the good results of the work of the road supervisors of the state in making better roads out of the ordinary roads of the state without entirely reconstructing them according to the standard specifications for state roads.

On the last day the discussion of maintenance of roads was opened by James Owen, county engineer of Essex county, New Jersey, with a paper which was an amplification of

the article by Mr. Owen in the November number of MUNICIPAL ENGINEERING. The discussion was continued by A. W. Dean, chief engineer of the Massachusetts Highway Commission, and by J. C. Travilla, street commissioner of St. Louis, whose paper was read by Mr. Meeker.

A little spice was added to the proceedings by a resolution introduced by Samuel Hill, which, in effect, called for an investigation of the United States Office of Public Roads. After it had been amended by the committee on resolutions to omit its ideas of the propriety and procedure it did not suit Mr. Hill and was withdrawn after a rather spirited discussion. On moton of C. A. Kenyon, president of the Indiana Good Roads Association, a committee of five experts was provided for to report standard specifications for maintenance of dirt, gravel, stone and bituminous macadam pavements.

The president in the course of his discussion of Mr. Hill's resolution, stated that the association had been reorganized and that he had become president on this understanding. The management has certainly improved and both delegates and exhibitors were on the whole well satisfied. The following were among the exhibitors present, some with full exhibits and some with simply headquarters for their representatives and friends:

Haywood Wagon Co., Newark, N. Y., dump wagons.

Hastings Pavement Co., 25 Broad St., New York City, asphalt blocks.

J. I. Case Threshing Machine Co., automobile road rollers, rock crushers, road graders, dump wagons, traction engines.

Glen Wagon Co., Seneca Falls, N. Y., dump cars for traction engines.

Everett Mfg. Co., Newark, N. Y., dump box.

Thew Automatic Shovel Co., Lorain, O.

C. H. Morse & Son, Rochester, N. Y., street signs.

Frick Co., Waynesboro, Pa., hauling engines.

Universal Road Machinery Co., Kingston, N. Y., stone crusher, screens and bins.

Wm. P. Tarrant, 12 Maple Ave., Saratoga Springs, N. Y., oil pump, conveying spout and spreading can.

Munnsville Plow Co., Munnsville, N. Y., cast iron culverts.

American Surety Co., 100 Broadway, New York.

Atlas Portland Cement Co., 30 Broad St., New York.

Barrett Mfg. Co., New York.

Warren Bros. Co., asphalt mixing plant, kettles, etc.

Buffalo-Pitts Co., Buffalo, N. Y., traction engines, cars, etc.

National Paving Brick Manufacturers' Association, Cleveland, O.

Wire-Cut Lug Brick Co., Conneaut, O.

Lane Bridge Co., Pointed Port, N. Y., distributing agents for Burch Plow Works Co., Crestline, O., cast iron culverts, road plows, etc.

Universal Portland Cement Co.

Bausch & Lomb Optical Co., Rochester, N. Y., surveying instruments, cameras, lenses, especially a new easily adjusted level.

Bituminized Road Co., Kansas City, Mo., "A dirt road transformed into a bituminous pavement."

Steel Protected Concrete Co., Philadelphia, Pa., Wainwright curb bar.

Acme Road Machinery Co., Frankfort, N. Y., dump wagons, etc.

Geiser Mfg. Co., Waynesboro, Pa., road rollers and hauling engines.

Knapp Machinery & Supply Co., 120 Liberty St., New York, eastern sales agents Concrete Form & Engine Co., Detroit, Mich., collapsible steel forms for concrete culverts, sewers and small bridges.

Amies Road Co., Bourse Bldg., Philadelphia, Pa., amiesite pavement.

American Asphaltum & Rubber Co., Chicago.

Barber Asphalt Paving Co., Philadelphia, Pa.

Hetherington & Berner, Indianapolis, brick rattler.

Mack Bros. Motor Car Co., Allentown, Pa., dump truck.

American Tar Co., Boston, Mass., Tarite.

Bituminous Road Implement Co., Boston, Mass., A. T. C. mixer and distributor.

The Texas Co., 17 Battery Place, New York.

Henry J. McCoy Co., 65 and 67 Dey St., New York, concrete carts and barrows, oil and asphalt distributers, tar kettles, Mullen gravel heater.

Bain Wagon Co., Kenosha, Wis., dump wagons.

United States Wood Preserving Co., 165 Broadway, New York, wood blocks.

International Harvester Co., gasoline traction engine.

Galion Iron Works Co., Galion, O., United Construction Co., Albany, N. Y., agents, dump wagons and corrugated and cast iron culverts and road scraper.

Sun Co., Philadelphia, Pa., asphalt and asphaltic oil.

A. Burlingame Co., Worcester, Mass., H-P. spreader for bituminous road material.

Standard Oil Co. of New York, 26 Broadway, New York, road oils.

Buffalo Steam Roller Co., Buffalo, N. Y., cable roller, scarifier, Buffalo-Pitts road rollers.

Standard Mfg. Co.. Worcester, Mass., Johnston Oil and Tar Spraying Co.

Ohio Road Machinery Co., Canton, O., road scarifier and grader.

R. D. Wood & Co., Philadelphia, Pa., cast iron pipe for culverts, etc.

Watson Wagon Co., Conestoga, N. Y., dump wagons.

Marion Steam Shovel Co., Marion, O.

Huber Mfg. Co., Marion, O., road roller.

National Mixer Co., Rochester, N. Y., small portable concrete mixer.

Eagle Wagon Works, Auburn, N. Y.

Rocmac Road Corporation of America, N. Tonawanda, N. Y., and Port Arthur, Ont., Rocmac binder and pavement.

Dolarway Paving Co., New York and Chicago.

Troy Wagon Works Co., Troy, N. Y.

Columbia Wagon Co., Columbia, Pa.

Beckley Perforating Co., Garwood, N. J., screens for stone crushers.

J. C. Marriott, New York, curb conduit.

J. Y. McClintock, Rochester, N. Y., reinforced concrete guard rail.

The American Civic Association.

Planning to secure the creation of a federal bureau of national parks, to be an adjunct of the department of the interior, in which project the co-operation of President Taft and of Secretary of the Interior Walter L. Fisher already is assured, and in general to give added impetus to the movement for "A More Beautiful America," the American Civic Association will hold its seventh annual convention in Washington, December 13, 14 and 15. Every phase of civic improvement work will be given consideration during the meetings.

Secretary Fisher will preside over the evening session of December 13, when the needs of the national parks will be presented. J. Horace McFarland, of Harrisburg, Pa., president of the association, in his annual address will answer the question, "Are National Parks Worth While?" and will urge upon the congress the creation of a federal bureau of national parks. The creation and maintenance by the states of state recreation reservations will be discussed, and reports will be received of advances along this line during the past year.

In the city planning sessions experts and business men will speak from their own experiences, to show the wisdom of applying system to the development of the aesthetic city. Major William V. Judson, U. S. A. engineer commissioner of the District of Columbia, will make an address on "Washington, the Model City."

The American Civic Association is a national organization engaged in arousing and assisting cities and communities in important efforts for their physical development.

The Association for Standardizing Paving Specifications.

The third annual meeting of the Association for Standardizing Paving Specifications will be held at the Hotel Grunewald, New Orleans, La. The date of the meeting has been changed to the week of January 8 to 13, inclusive, 1912. Delegates may make reservations through Capt. W. J. Hardee, city engineer, City Hall, New Orleans, La. In order that the work of the various committees may be evpedited and just criticism avoided if possible, the association requests that any one advocating a change in the specifications as published in the copyrighted proceedings of the second annual meeting held in New York this year, address, at the earliest possible date, the proper chairman suggesting, in writing, with the reasons therefor. All communications addressed to the secretary after January 4 should be directed to the Hotel Grunewald. John B. Hittell, secretary-treasurer, 5917 Winthorp avenue, Chicago, Ill.

Calendar of Technical Meetings.

American Public Health Association.—Annual Convention, Havana, Cuba, December 4-9. William C. Woodward, M. D., secretary, District Bldg., Washington, D. C.

Association of American Portland Cement Manufacturers.—Annual Meeting, New York City, December 11-13. Percy H. Wilson, secretary, Land Title Bldg., Philadelphia, Pa.

American Institute of Architects.—Annual Convention, Washington, D. C., December 12-14. Glenn Brown, secretary, The Octagon, Washington, D. C.

American Institute of Chemical Engineers.—Annual Meeting, Washington, D. C., December 20-22. J. C. Olsen, secretary, Polytechnic Institute, Brooklyn, N. Y.

American Society of Agricultural Engineers.—Annual Meeting at St. Paul, Minn., December 27-29. J. B. Davidson, secretary, Ames, Ia.

American Association for the Advancement of Science.—Annual Meeting, Washington, D. C., December 27-January 3. L. O. Howard, secretary, Smithsonian Institute, Washington, D. C.

Pacific Northwest Society of Engineers.—Annual Meeting at Seattle, Wash., January 6. Joseph Jacobs, secretary, 803 Central Bldg., Seattle, Wash.

American Society of Engineering Contractors.—Annual Meeting at New York City, January 9. J. R. Wemlinger, secretary, 13 Park Row, New York City.

Second Annual New York Cement Show.—Madison Square Garden, January 29-February 3. J. P. Beck, general manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Fifth Annual Chicago Cement Show.—Coliseum, February 21-28. J. P. Beck, general manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

First Annual Kansas City Cement Show.—Convention Hall, March 14-21. J. P. Beck, general manager Cement Products Exhibition Co., 72 W. Adams street, Chicago, Ill.

Technical Schools.

A revision of the old courses and the addition of two new courses in the department of mechanical engineering has been proposed by Prof. E. F. Miller, of the Massachusetts Institute of Technology. In brief, the changes include lengthening the course in hydraulics, more work in electrical engineering, a more complete course in refrigeration, additional studies of the

small gas engine and sufficient German to read German scientific periodicals.

Bruce W. Benedict, for several years in the motive power department of the Atchison, Topeka & Santa Fe Railway Co., has been appointed director of the shop laboratories in the department of mechanical engineering at the University of Illinois. Mr. Benedict was born in Buda, Ill., in December, 1876. He graduated from the University of Nebraska in the class of 1901.

Prof. Emory R. Johnson, of the University of Pennsylvania, has been appointed by President Taft, special commissioner to investigate the prospective traffic through the Panama canal, for the purpose of fixing upon an equitable tonnage rate.

"Tests of Nickel-Steel Riveted Joints," by Arthur N. Talbot and Herbert F. Moore, has just been issued as Bulletin No. 49 of the Engineering Experiment Station of the University of Illinois. This bulletin describes tests of riveted joints of nickel-steel in tension and in alternated tension and compression. The slip of rivets and the strength of joints were determined. From the tests, the general conclusion is drawn that in riveted joints, designed on the basis of ultimate strength, the use of nickel-steel may be of advantage; but that in riveted joints designed on the basis of frictional hold of rivets, while it may be advantageous to use nickel-steel for the plates, rivets of ordinary steel seem to resist slip as well as rivets of nickel-steel.

The following non-resident lecturers in highway engineering for 1911-1912 have been appointed at Columbia University: John A. Bensel, M. Am. Soc. C. E., New York state engineer, Albany, N. Y.; Walter W. Crosby, M. Am. Soc. C. E., chief engineer Maryland State Roads Commission, Baltimore, Md.; A. W. Dow, chemical and consulting paving engineer, New York City; Walter H. Fulweiler, Assoc. M. Am. Soc. C. E., chief chemist United Gas Improvement Co., Philadelphia, Pa.; John M. Goodell, Assoc. Am. Soc. C. E., editor-in-chief Engineering Record, New York City; Nelson P. Lewis, M. Am. Soc. C. E., chief engineer board of estimate and apportionment, New York City; Logan W. Page, M. Am. Soc. C. E., director United States office of public roads, Washington, D. C.; Harold Parker, M. Am. Soc. C. E., chairman Massachusetts Highway Commission, Boston, Mass.; Charles P. Price, Assoc. Am. Soc. C. E., manager American Tar Co., Malden, Mass.; H. B. Pullar, chief chemist American Asphaltum and Rubber Co., Chicago, Ill.; John R. Rablin, M. Am. Soc. C. E., chief engineer Massachusetts Metropolitan Park Commission, Boston, Mass.; Clifford Richardson, M. Am. Soc. C. E., consulting engineer, New York City; Phillip P. Sharples, chief chemist, Barrett Manufacturing Co., Boston, Mass.; Francis P. Smith, M. Am. Soc. C. E., chemical and consulting paving engineer, New York City; Albert Sommer, Assoc. Am. Soc. C. E., consulting chemist, New York City; George W. Tillson, M. Am. Soc. C. E., consulting engineer Borough of Brooklyn, New York City.

Technical Associations.

At a recent meeting of the Rochester Engineering Society, John C. Parker, of the Rochester Railway and Electric Co., delivered an address on the subject "Compensation for Engineering Services," in which he stated that the engineers are the poorest paid professional men.

At the regular monthly meeting of the American Society of Engineer-Draftsmen, held in the Engineering Societies' Bldg., New York City, November 16, papers were presented on "Construction Work West of the Missouri River," by Walter Dalton, and on "Comprehensive Drafting and Lettering," by Charles W. Reinhardt, chief draftsman, Engineering News.

At a regular meeting of the Cleveland Engineering Society, held on November 14, the following papers on water works subjects were presented: "Purification by Filtration," R. Winthorp Pratt, Cleveland, O.; "Purification by Chemicals, and Interpretation of Water Analyses," Dr. R. G. Perkins, Western Reserve Medical College; "Purification by Ozone,' R. M. Leggett, The National Air Purifying Co., Ann Arbor, Mich.; "Purification by Electricity," D. D. Vincent, The Electra Pure Water Co.

At a meeting of the Brooklyn Engineers' Club, on November 9, a resolution requesting Gov. John A. Dix to appoint an engineer to the New York City public service commission, when the next vacancy occurs, February 1, 1912. In discusing the resolution, it was pointed out by referring to specific recent cases that administrative offices requiring an engineer's training are usually filled by lawyers or politicians. The resolution was carried unanimously, and the officers of the club subsequently forwarded a copy to the governor. The nominees for president and secretary are W. T. Donnelly and Joseph Strachan. The annual meeting will be held December 14.

The American Society for Promoting Efficiency is being organized by a committee, among whom are the following: T. C. DuPont, Wilmington, Del.; P. W. Gates, Chicago, Ill.; Henry W. Tawne, New York City; Harrington Emerson, New York City; John Hays Hammond, New York City; Alexander C. Humphreys, New York City; William Kent, New York City; John F. Wallace, New York City; J. G. White, New York City; Edmund J. James, Champaign, Ill.; Herman Schneider, Cincinnati, O.; Charles B. Going, New York City, and Charles Kirchhoff, New York City. The object of the society is "to promote efficiency in commercial and industrial enterprises of all kinds, including public service corporations." H. F. J. Porter, 1 Madison avenue, New York City, is secretary.

The Engineers' Club of Baltimore has undertaken the publication of a monthly "Journal," of which the first issue, November, 1911, has recently been published. It contains articles on "The Public Service Commission of Maryland," by Charles E. Phelps, and on "Baltimore as an Industrial City; and the Factory Site Commission," by A. S. Goldsborough; editorials on "The Journal" and "The Engineers' Club," and a complete reprint of the club's proposed charter and amended by-laws. The editors are Oscar F. Lackey, John H. Milburn and John K. Flick.

The Texas Good Roads Association was organized at a meeting held in Dallas, Tex., on October 27. The following officers were elected: President, O. E. Dunlap, Waxanachie; first vice-president, John Warren, San Antonio; second vice-president, Judge Cato Sells, Celbourne; third vice-president, Homer D. Wade, Waco; general secretary, George W. Baker, Dallas; general engineer, Prof. R. J. Potts, College Station.

At a regular meeting of the Municipal Engineers of the City of New York, Calvin Tomkins, commissioner of docks and ferries, city of New York, presented an illustrated paper on "The Port of New York."

The twelfth annual convention of the Washington State Good Roads Association was held at Wenatchee, Wash., on October 19, 20 and 21. The following is a brief summary of the convention proceedings: Recommended four state roads to be built by state bonds. Ordered the codification of existing state road laws. Indorsed convict labor on roads in city, county and state penal institutions. Recommended that where a convict is about to leave such an institution without funds he should be permitted to work on roads to gain money to face the world. Indorsed the fundamental principles of the present state road law. Recommended that instead of one payment for road assessment it be made in not less than five payments and at 6 per cent. interest. Asked the state highway commissioner to prepare map, showing system of existing and proposed roads for distribution. Indorsed a memorial to congress asking relief for western Washington in the Olympic reserve, and asking that the national government build roads to the summits of the national parks. Recommended to county commissioners that good county roads be constructed from trade centers, and that branch roads be improved in proportion to their importance. Resolved that no permanent road should be built on more than a 5 per cent. grade. Appointed a committee to investigate the new pavement in Scioto county, Ohio. Formally made Samuel Hill honorary life president. The following officers were elected for the ensuing year: S. A. Perkins, Tacoma, president; John P. Hartman, Seattle, firse vice-president; W. T. Clark, Wanatchee, second vice-president; L. L. Bush, Pacific, third vice-president; W. F. Marble, fourth vice-president; D. B. Hillop, Klickitat, fifth vice-president; W. L. Steinmeg, North Yakima, treasurer.

Personal Notes.

John M. Hackett has been elected as city engineer of Dunkirk, N. Y.

Edward Cassidy, Pueblo, Col., has opened an office for the practice of civil and hydraulic engineering.

R. H. Thomson, since 1892 city engineer of Seattle, Wash., has been elected engineer of the Port of Seattle.

Ross Canterbury has resigned as city engineer of Peoria, Ill., to take up private engineering construction.

Walter McCulloh, consulting engineer of the New York State Water Supply Commission, has resigned.

C. G. Reel, of Kingston, N. Y., has been appointed superintendent of highways of the state of New York, succeeding the late William H. Catlin, who died recently. Mr. Reel has been serving recently as first deputy in the state highway department.

Walter H. Evans, formerly superintendent of track and roadway of the Indiana Union Traction Co., at Anderson, Ind., has been appointed manager of the motor gear department of the Edgar Allen American Manganese Steel Co., with headquarters in Chicago, Ill.

Prevost Hubbard, chief of the division of roads and pavements of the Institute of Industrial Research, has been appointed lecturer in engineering chemistry at Columbia University. He will conduct the courses in highway engineering.

Beginning with the November number, the Twentieth Century Magazine will be edited by Charles Zueblin. B. O. Flower, the former editor, is still a member of the board of directors, and will be a frequent contributor. He has resigned to take up independent literary work.

DeWitt V. Moore, C. E., formerly of the Moore-Mansfield Construction Co., and the Mansfield Engineering Co., has disposed of his interests in the above concerns, and in the future will maintain an individual office as consulting engineer and contractor. In connection with these offices an association has been formed with the W. C. Halsted Co., building contractors, with offices at 513-16 Indiana Pythian Bldg., Indianapolis, Ind.

The city of Muskogee, Okla., with mutual consent, has abrogated its contract with Alexander Potter to act simply as an advisory engineer on the improved water supply sewerage system and garbage disposal plant now under construction, and has entered into a new contract with him, placing the entire engineering work under his direction, control and responsibility.

A new engineering organization for the municipal work of Jacksonville, Fla., has been formed, similar to that of Washington, and several members of the Washington engineering department have been appointed to the principal positions. Capt. Edward M. Markham, Corps of Engineers, U. S. A., who is serving as assistant to the engineer commissioner of the District of Columbia, is retained as consulting engineer, but will also continue in his present connection. L. D. Smoot, formerly assistant engineer of highways at Washington, is appointed city engineer of Jacksonville. J. R. Whelpley, formerly assistant engineer in the sewer department at Washington, will be in charge of sewer and water works construction; J. E. Ballinger will be engineer of highways, and R. Y. Middleton, chief draftsman.

MACHINERY AND TRADE

National Association of Road Material and Machinery Manufacturers.

At the Richmond Road Congress, November 21, there was formed the National Association of Road Material and Machinery Manufacturers. The charter members of the association include the leading concerns in the United States engaged in the road building industry. Member companies must be road material or machinery manufacturers, and not primarily contractors or dealers.

W. T. Beatty, of the Austin Manufacturing Co., Chicago, was elected president of the association; S. Jones Philips, of the American Road Machinery Co., vice-president; Daniel T. Pierce, of the Barber Asphalt Paving Co., secretary and treasurer. The office of the association will be at 32 Liberty street, New York City.

Those who have been elected and accepted for representation on the board of directors of the association are: Nat Tyler, Jr., Monarch Road Roller Co.; B. C. Hvass, Charles Hvass Co.; H. P. Goodling, A. B. Farquhar Co.; Henry Fisher, Standard Oil Co.; Charles P. Price, American Tar Co.; R. K. Pierce, Solvay Process Co., and J. S. Robeson, Robeson Process Co. The Texas Co., Studebaker Corporation, Watson Wagon Co. and four other manufacturers will have representation on the board.

The annual meetings of the association will be held in connection with a yearly exhibit, under the auspices of the association. It is hoped that arrangements can be made for the annual exhibit at joint conventions of the principal good roads organizations.

A New Design of Controllable Concrete Dump Bucket.

The Ransome Concrete Machinery Co., Bucket Dept., Dunellen, N. J., has just put on the market a new design of concrete dump bucket that is especially adapted for placing concrete in thin walls, even as thin as 3-inch, without waste or extra handling, while at the same time it is a generally useful bucket and has ample volume.

The section of the bucket is a right-angle triangle with the vertical side free from all mechanism. The dumping devices are located on the hypotenuse and thus the operation of the bucket is easily effected without interference from projecting steel reinforcement rods or forms. In operation the vertical side is brought up against the steel work.

The dumping device is simple, and readily controlled by a handle operating a cam that bears on an equal arm lever that connects by another lever to the drop bottom. The operator has ready control over the amount of concrete to be placed and by moving the bucket forwards and backwards can place concrete in thin layers as desired. It will be noticed that this bucket can be placed directly against vertical steel rods throwing the contents of the bucket between them. The shape of the drop bottom is such that with a little experience the operator can cast the concrete through a steel system from 4 to 6 feet wide.

The straight side gives a clear fall by gravity to the concrete which completely clears the bucket, thus reducing to a minimum the time for ordinary cleaning operation. When desired the bucket is furnished with legs so that it can be set down in an upright position. The bucket is fully patented.

It has been used with much success by contractors J. B. Smith & Co., in erecting the inclined reinforced concrete abutments for the overhead double track crossing on the Western and Atlantic Railway at McCarty, Tenn.

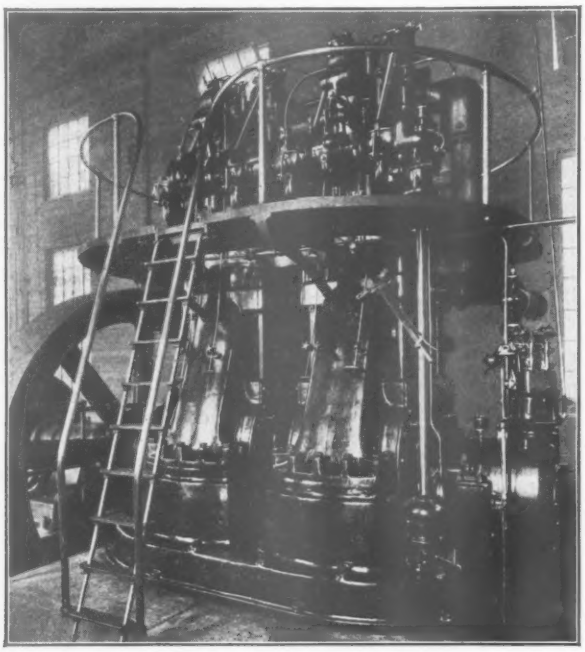
The Atlas Crude Oil Engine.

The Diesel type of crude-oil engine has been the object of widespread interest of the engineering fraternity for years. Its remarkable fuel economy is probably not equalled by any other type of prime mover, and announcement of the fact that the Atlas Engine Works, of Indianapolis, is taking up its manufacture, embodying in the new machine some important improvements, mainly along lines of simplification of design and making all working parts accessible, is of interest. This concern will market this type of engine under the name "Atlas Crude-Oil Engine," and will build in sizes of 300, 450 and 600 B. H. P. (2, 3 and 4 vertical cylinders.)

Since this internal combustion engine has been so successful in operation abroad and has become so generally adopted, it is only natural that it should be of great in-

terest to manufacturers in this country. Engines of the Diesel type are not only in general use in England, Germany, France, Belgium and Russia, but are now being installed in war and merchant vessels. Prince Henry, of Germany, recently predicted that within ten years all warships will be operated by engines of the Diesel type. It occupies much less space than the old-time boiler and engine equipment, and the gain in cargo capacity is important.

The distinctive feature of this type of engine is, of course, its wonderful economy and absolute dependability. The simplicity of the Atlas design of this type of engine is interesting. The entire valve mechanism is accessible from the outside, and the only working parts in the crank case are the crank and connecting rod, thoroughly lubricated with the splash. The cylinder head can be removed without disturbing any of the valves or valve adjustment, all other adjustments can be made easily and quickly, most of them while the engine is in operation. The Diesel principle of fuel combustion is followed closely. There is no complication of parts. Fuel is controlled automatically, so closely that the amount used at half load is just about one-half that used at full load, with an unusually high efficiency on light loads. The engine develops one brake horsepower on less than one-half pound of fuel of average calorific value and weight, which, figured at two cents a gallon (the present average price) would cost $1.35 per ten-hour day for 100 B. H. P. per hour, or, $2.00 per day for 100 K. W. per hour. Nothing can equal it unless it be water power, and then only when the natural advantages are practically ideal. It consumes only about one-half of the heat that a producer gas plant would and about 20 per cent. of that used by a steam plant. It does away with boilers and all fire room expense, doubts about coal supply, ashes, and the time wasted in getting up steam. Furthermore, it is sold on definite guarantees of fuel consumption.



THE ATLAS CRUDE OIL ENGINE.

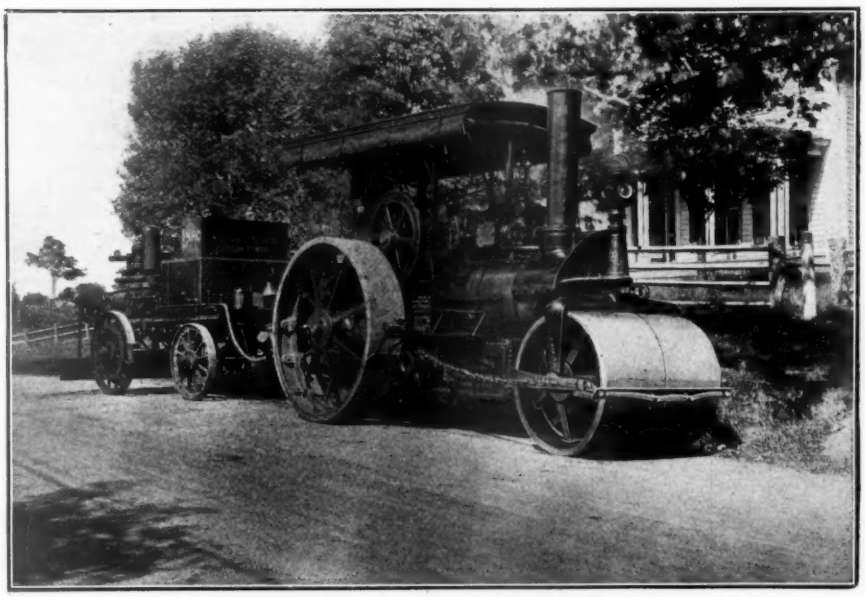
A very interesting test has recently been made on one of these machines by C. E. Sargent, M. E., of Chicago, and a copy of it, together with a brief bulletin describing the engine, will be worth reading by anyone interested in the problem of economical power. Both may be had upon application to the Atlas Engine Works, Indianapolis, Ind.

Eclipse Mixers in Chicago.

The recent street paving work in the city of Chicago attracted considerable attention in view of the novel method of disposing of the old granite blocks which were torn up and crushed in a stone crusher and deposited in piles on the street. These crushed granite blocks together with the

screenings from same and sand were mixed together and formed the concrete base for the new paving, which was built in accordance with the specifications of the Local Board of Improvements and consists of a concrete base eight inches in thickness, a 1-inch cushion of sand and a surface of 4-inch creosoted pine blocks. By using the granite blocks in this way the expense of removing same and the cost of the crushed stone as well as that of hauling the crushed stone was avoided. Two Eclipse Low Charging Concrete Mixers, manufactured by the Standard Scale and Supply Co., were used to rush the work, several hundred yards of concrete being placed every day with each machine. The mixers were operated on the street between the car tracks and the curb and were moved forward as the work progressed.

An interesting point is that the contract was completed and the last of the wood block pavement placed in position late Saturday evening, November 11th, the day before a severe storm and cold wave hit Chicago.



THE BUFFALO-PITTS STEAM ROLLER.

Differing Uses of the Steam Roller.

The many uses to which a first-class steam roller like the Buffalo Pitts, can be put are admirably illustrated and set forth in a catalogue recently issued by the Buffalo Steam Roller Company, of Buffalo, N. Y. It points to the fact that such a machine can be used in all forms of highway improvement and can perform in such work many different offices. It can be used as stationary power for running a stone crusher and can haul a portable crushing outfit from place to place. It is also most economical for hauling road material in wagon trains. For country highways it can pull road graders and roll the earth at the same time. For macadam roads it will roll the subsoil, the Telford base, the courses of broken stone and the bituminous surface. Old roads can be picked up or scarified, reshaped and rolled down again, all with the steam roller and with very little expense. They call particular attention to the small cost of operation and to the fact that a steam roller can be used to much better advantage than a gasoline machine as the steam from the boiler is often needed for running rock drills and steam pumps and it is absolutely necessary for heating tar or oil tanks when spreading bituminous material. The delay in starting a gasoline machine on cold mornings, the excessive vibrations when the engine is running and the various annoyances incidental to operating a gasoline machine are absent in a steam roller.

As most gasoline rollers have but a single cylinder with only one explosion for every two revolutions of the crank shaft, only one-eighth as many running impulses are given to the driving mechanism as in the case of the double engine steam roller, the crank shaft of which receives four impulses for every revolution. Consequently

the strains upon the driving gear of the gasoline machine are many times more severe than those put upon the driving gear of a steam roller. The result is the much longer life of the steam machine.

The Buffalo Pitts was the first steam roller manufactured in America that is still on the market. As it has had the longest period in which to be brought to perfection by its manufacturers, its efficiency and durability have been proven.

Change of Address of the Birmingham Office of the H. W. Johns-Manville Co.

Due to the fast increasing business in Birmingham, Ala., the H. W. Johns-Manville Co. has found it necessary to change the location of its office from 1220 Empire Bldg. to 606 Chamber of Commerce Bldg., this address being better adapted for its requirements. This office will continue under the management of Mr. W. H. Fleming, who was connected with the New Orleans branch of this company for a considerable time. A complete line of the J-M asbestos and magnesia products, electrical supplies, packings, etc., will be handled from this office.

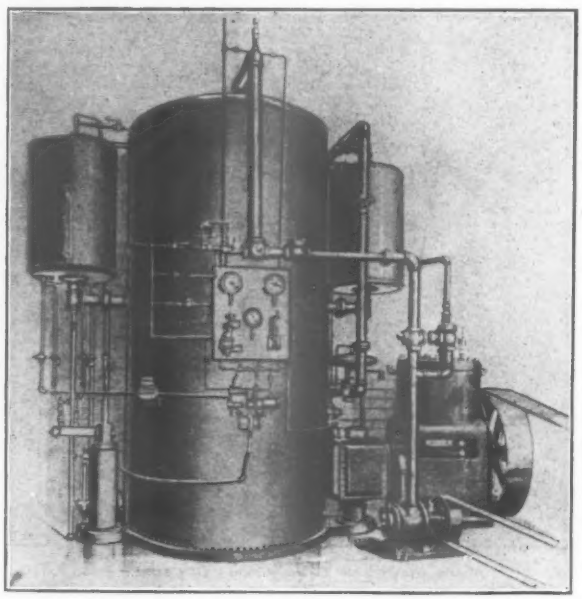
Change of Address of A. Eugene Michel.

The main offices of A. Eugene Michel and staff, advertising engineers, have been moved into the Park Row Bldg., 21 Park Row, New York City, where larger space has been secured, as necessitated by constantly increasing business. Temporarily the photo retouching and illustrating department will remain in the Hudson Terminal Bldg., but all business will be managed from the new offices.

A Practical Small Town Gas Plant.

The question of the efficient and economical lighting of small towns and villages, from a central plant, has not until very recently been satisfactorily settled. Various schemes for manufacturing gas, such as acetylene and gasoline plants, have been tried, but have in the main been entirely unsatisfactory.

The Practical Gas Engine and Machine Works, 1916 State street, Chicago, have produced a gas plant known as the "Practical Alternating Cold Process Gas Machine," which is giving entire satisfaction as a small town plant; manufacturing gas for both light and fuel at a price on a par with the large city plants. There are at present about 160 of these plants in operation, and entire satisfaction with all features of the machine has been expressed. As an economical plant for a town of from 400 to 1,500 population, it has no superior. The following comparison between a small electric plant and one of the cold process gas machines serves to illustrate the economy of the machine:



THE PRACTICAL ALTERNATING COLD PROCESS GAS MACHINE.

An 1,800 alternating cold process gas

works will supply gas for 1,8000 full 70-c.p. light, making in all, lights for 126,000 c.p., requiring only a 12-h.p. engine to drive the compressor, blower, etc., and requiring about two hours' run morning and night.

To operate an electric light plant to supply 1,800 lamps of 16 c.p., requires 180-h.p. engine; and if the electric light plant should furnish the same amount of candle power as the 1,800-light cold process gas works, it would need to have the push of an engine of 787 h.p.

A comparison between the cold process machine and an acetylene plant is given by S. F. Critz, of Riverside, Ia.: "The cost compared to acetylene for the same amount of light is half or less; with no dirt or smoke, blacking of mantle, but a clean, steady white light. There are three discarded acetylene gas machines in our town of Riverside, all of which can be bought at less than one-fourth of their cost."

The Practical Gas Engine and Machine Works install the plants complete. Ordinarily for a town of 1,200 population a plant can be installed for $8,500 complete, and in running order. This includes the building which is composed of brick, composite rubberoid roof, 11 ft. high, 24 ft. wide, 24 ft. deep, concrete floor and the machinery installed there on concrete foundations; also the mains running in size from 3 to 1¼ inches, the length of which is about 10,000 ft. For smaller towns, requiring 5,000 to 6,000 ft., the price of the plant would be in proportion to the above, perhaps $7,500.

The accompanying illustration shows a typical installation.

Trade Publications.

The Warren Bros. Co., 59 Temple Place, Boston, Mass., has for distribution an illustrated booklet on "Warrenite," a bituminous concrete surface for country roadways. Examples are given of roads built of this material, which were constructed in 1902 and are still in excellent condition. The material has been extensively used on Eastern road work, over 453,000 sq. yds. having been laid previous to October 1, 1911.

The monthly bulletin of the Universial Portland Cement Co., Chicago, Ill., contains among other matters of interest a description with illustrations of some of the concrete bridges in the parks of Minneapolis, Minn.

The Goulds Manufacturing Co., Seneca Falls, N. Y., has issued Bulletin No. 101, which fully describes its triplex plunger pumps. The pumps shown are designed on the same general lines throughout, but details of construction are varied somewhat under different working conditions and pressures, the latter ranging from 130 lbs. or 300 ft. elevation to 200 lbs. or 460 ft. elevation. This bulletin is prepared for free distribution among those interested.

The Jeffrey Manufacturing Co., Columbus, O., has an exceptionally complete catalog on power and transmission. It contains a great amount of valuable technical information in a condensed but complete form. Besides listing dimensions and sizes of every part in this line, there is descriptive matter on the horse powers of steel shafting, standard methods of key seating, sizes and dimensions of couplings, hangers, pillow blocks, counter shafts, belt tighteners, clutches and quills. A feature is made of the Jeffrey improved split iron pulley, which may be readily clamped on the shaft without disturbing any other equipment, or may easily be removed from the shaft when necessary. A complete line of wood split pulleys and a very complete description and information on rope driving are shown. In addition there are quite a number of details in the rear part of the book, including horse power of belts, method of calculating bending and torsional moments for shafts, which are valuable to the engineering fraternity.

Bulletin No. 20, dealing with the economy improvements and operating conveniences of Kerr turbo-blowers and turbo-pumps, particularly in gas plant service, has just been issued by the Kerr Turbine Co., Wellsville, N. Y. This bulletin contains interesting comparisons with other driving methods for the same work, and illustrates a number of installations. "Be Ready for the Long Dark Nights" is the title of Bulletin No. 22, just issued by the same company, describing and illustrating installations of their turbo-generator sets for lighting.

The International Harvester Co., Chicago, Ill., has printed for free distribution a new booklet entitled "The Story of Bread." This booklet comprises 28 pages and tells the story of bread in an interesting and instructive way.

The Schutte & Koerting Co., Philadelphia, Pa., has a new catalogue, section 6-B, on Koerting centrifugal spray nozzles for recooling condensing water, also gas engine jacket water, etc; and a revised bulletin, 5-B, on multi-jet condensers.

The DeLaval Steam Turbine Co., Trenton, N. J., has a small but very complete and interesting booklet, describing a steam turbine for driving direct current generators. A discussion of the different types of steam turbines and their comparative merits is also given. Complete illustration by photographs and line drawings serve to give a clear idea of the points discussed. The spiral gear feature of the DeLaval turbine is fully described.

There is probably no more important subject in connection with the manufacture of concrete than that of properly selecting and proportioning the aggregates. The Vulcan Portland Cement Co., Fifth avenue, New York City, has just issued the third edition of its twenty-six page pamphlet, entitled "The Selection and Proportion of Aggregate for Concrete.

The Wemlinger Steel Piling Co., 11 Broadway, New York, N. Y., has a twenty-page booklet, describing its corrugated steel sheet piling and its use on various classes of work.

The H. W. Clark Co., Mattoon, Ill., has a card suggesting the advantages of the Clark meter box and the "Texsagon" coupling for use at the meter. A rapid and secure meter installation is demonstarted by a series of photographs.

The Reinforced Concrete Pipe Co., San Francisco, Cal., has a very complete and excellently illustrated publication, showing the adaptability of reinforced concrete pipe for sewers, both sanitary and storm, and for water conduits. Examples are shown of numerous pressure conduits, siphons and pipe lines of 30, 36 and 42 inches in diameter. Tests and details are fully explained in the book.

Merritt & Co., Camden, N. J. have a publication fully describing the Priestman ejector system, which was noted in a recent issue of MUNICIPAL ENGINEERING.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

St. Elmo, Ill.—P. E. Fletcher, city engineer, desires prices f. o. b., St. Elmo, on paving brick, grates for catch-basins and sewer tile.

Brazil, Ind.—Dec. 14, 10 a. m. Constructing gravel or macadam road in Boone and Webster townships. E. A. Staggs, auditor.

Columbus, Ind.—Dec. 14, 10 a. m. Constructing macadamized road in Clisty township and gravel roads in Jackson township. Philip J. Sater, auditor.

Huntington, Ind.—Dec. 18, 10 a. m. Constructing gravel road in Huntington township. John W. Weaver, auditor.

Lafayette, Ind.—Dec. 6, 10 a. m. Constructing three gravel roads. Geo. W. Baxter, auditor.

Lawrenceburg, Ind.—Dec. 5, 12 m. Improving highways in Jackson township. William F. Fagaly, auditor.

Logansport, Ind.—Dec 5, 10 a. m. Constructing stone road in Miami township. J. E. Wallace, auditor.

Logansport, Ind.—Dec. 5, 10 a. m. Constructing gravel road in Clinton township. J. E. Wallace, auditor.

Paoli, Ind.—Dec. 5, 2 p. m. Constructing a road in Paoli township. Alvin B. Ham, auditor.

Valparaiso, Ind.—Dec. 5, 10 a. m. Constructing gravel road in Portage and Boone townships. C. A. Blachley, auditor.

Winamac, Ind.—Dec. 5, 12 m. Constructing public highway. W. E. Munchenburg, auditor.

New Orleans, La.—Dec. 11. Constructing 9½ miles of highway between New Iberia and Jeanerette. Frank M. Kerr, state engineer, 104 New Orleans Court.

Winona, Minn.—Jan. 10, 1912. Constructing about twenty miles of macadam roadway. Jos. Winczwsky, county auditor.

CONTRACTS AWARDED.

Birmingham, Ala.—The following paving contracts have been awarded: Macadam on Thirteenth street, to the Southern Asphalt Co., $3,254; macadam on Ensley to the same, $15,031; Third avenue, to Paul Richter, $1,408.

Bakersfield, Cal. — Reconstructing the Coles Levee road, to G. B. Mosher, $14,010.

Madera, Cal.—Paving construction to the Ransome-Crumme Co., Oakland, Cal., $96,-110.

Quincy, Cal.—Constructing the Seneca road, to Geo. M. White, $7,680.

Richmond, Cal.—Paving Twenty-third street, to L. L. Page, $4,650; paving Neamin avenue, to Galbraith Bros., $7,892.

Hartford, Conn.—The following state road contracts have been awarded: 10,950 feet in the town of Plymouth, to the Pierson Engineering and Construction Co., Bristol, Conn.; 9,564 feet in Berkamsted, to Caesar A. Rossi, of Torrington, Conn.; 6,009 feet in Southington, to John F. Knapp, of Belden Hill, Conn.; 7,860 feet in Sommers, to A. B. Bridges Sons Co., of Hazardville, Conn.; 14,150 feet in Wolcott, to Joseph E. Aloia, of Cromwell, Conn.

Lewiston, Ida.—Laying 25,000 sq. yds. of paving, to the Inland Empire Hassam Paving Co., of Spokane, Wash.

East St. Louis, Ill.—The following street improvement contracts have been awarded: Twenty-first street, to J. P. Kelly, $7,768; Eighteenth street, to same, $7,532; Broadway, to Meyer & Thomas, $29,125; Exchange avenue, to the Meyers Construction Co., $26,022.

Rantoul, Ill.—Paving contracts have been awarded to H. C. Finley, of Hoopeston, Ill., $24,000.

Logansport, Ind.—Constructing the Hoffman road, to J. H. Novinger, $10,680.

Clinton, Ia.—Constructing 74,960 sq. ft. of cement walk, to Carey & Son.

Wichita, Kan.—The following street improvement contracts have been awarded: Mentor avenue, to H. L. Miles; constructing curb and gutter on Mentor street, to A. T. Buckeridge; constructing curb and gutter on University avenue, to Myers & Newcomb; paving Fountain avenue, to the Rackliff-Gibson Construction Co.; paving Second street, to John Ritchie & Son.

Louisville, Ky.—Paving Fourth avenue with creosoted wood block, to Geo. W. Gosnell, $15,001.

Lake Charles, La.—Constructing 18,000 ft. of curb and 90,000 sq. ft. of sidewalk, to DeLatte & La Grange, of Lake Charles.

New Orleans, La.—Paving Carondelet street with asphalt, to the Barber Asphalt Co., Boston, Mass., $41,000; graveling Howard avenue, to Craven & Co., $3,624.

Baltimore, Md.—Paving construction, to the F. E. Schneider Paving Co., $48,928.

Baltimore, Md.—Constructing 2.6 miles of road, to George Jewell, $45,443.

Boston, Mass.—The following paving contracts have been awarded. Southampton street, to McGuire & Kiernan, $52,647; Stratford street, to the West Roxbury Trap Rock Co., $9,927; constructing macadam roadway on Morton street, to John Kelly Co., $10,000; laying wood block pavement, Northampton street, to the S. F. & A. B. Gore Corporation, $9,971; macadam roadway on Stratford street, to the West Roxbury Trap Rock Co., $9,927; paving Southampton street, to McQuire & Kiernan, $52,-647; constructing macadam roadway on Floyd street, to James Doherty, $3,433.

Batesville, Miss. — Constructing three miles of sidewalks, to P. T. Powers & Son, of Memphis, Tenn., about $10,000.

Brunswick, N. J.—Constructing new road at Highland park, to Thomas H. Riddle, of Brunswick, $53,333.

Flemington, N. J.—Constructing a macadam road between Clinton and Hampton, to M. I. Demarset, of Sewaren, N. J., $57,-252.

Kearney, N. J.—The following paving contracts have been awarded: Kearney avenue, to Van Keuren & Son, $60,281; paving Midland avenue, about 8,500 ft., to Van Keuren & Son.

Newark, N. J.—Improving Trenton ave-

nue, including 5,200 ft. of Telford pavement, to R. G. McManus, $13,380.

Rahway, N. J.—Paving Main street with brick, to the Jersey Paving Corporation, of Newark, $24,000.

Buffalo, N. Y.—Paving Huron street, to Henry D. Burgard Co., $15,050.

New York, N. Y.—The following street improvement contracts have been awarded: Paving Terrace View avenue, to the Harlem Contracting Co., 2 Rector street, New York, $10,316; section 2, of Terrace avenue, to the same, $4,505; improving Elwood street, to the Goodwin Construction Co., 30 Church street, New York, $6,549.

Bryan, O.—Improving the Bryan-Defiance road, to the Kelly Construction Co., of Bryan, $13,506.

Caldwell, O.—Paving New street, to Wilson & Harber, of Barnesville, O., about $11,000.

Columbus, O.—Improving three miles of roadway, to Radabaugh & Imbodin, of Logan, O., $12,390.

Lisbon, O.—Constructing 1.06 miles of brick paving, to Geo. B. Patterson, of Wellsville, O., $13,170.

Upper Sandusky, O.—Macadamizing two miles of road, to Carroll & Gruber, $12,769.

Palestine, O.—Paving 5,000 ft. of the Elkton road, to Geo. B. Patterson, of Wellsville, O., $13,172.

Bartlesville, Okla. — Paving contracts have been awarded as follows: To Plunkett & Yale, Coffeyville, Kan., $27,000; to Waltham, Hanna & Clark, $20,000; paving Osage avenue with bitulithic, to P. S. Kaull, American National Bank building, Kansas City, Mo., $34,000.

Hugo, Okla.—Constructing asphalt pavement, to the Shelby Downard Asphalt Co., of Ardmore, Okla., $125,000.

Portland, Ore.—The following paving contracts have been awarded: Front street with bitulithic, to the Warren Construction Company, $4,926; Jefferson street, to the same, $11,224; Woodward avenue, to the same, $855; East Seventh street, to the Oregon-Hassam Paving Co., $1,745; East Thirty-second street, to the Barber Asphalt Paving Co., $3,360.

Salem, Ore.—Paving McMinnville street, to the Warren Construction Co., of Portland, Ore., $120,000.

Greensburg, Pa.—Constructing extension of the Greensburg Country Club road with amiesite, to Chas. E. Eastburn, of Yardley, $20,360.

Monongahela, Pa.—Constructing 60,000 sq. yds. of brick pavement, to M. Erbeck, of Homestead, Pa.

Philadelphia, Pa.—The following paving contracts have been awarded: West Moreland street, $2,400, Cresson street, $2,300, Sixty-second street, $19,200, Walnut lane, $10,000, all to the Cunningham Paving and Construction Co.; paving Stonehouse lane, to James Irvin, $7,600; improving Crittenden street, to John Perrigan, $1,700.

Philadelphia, Pa.—Repaving Race street pier with wooden block to The Filbert Paving and Construction Co., Pennsylvania building, Philadelphia, $13,000.

Pittsburg, Pa.—The following street improvement contracts have been awarded: Paving Corday alley, to Booth & Flinn, $3,741; paving Wilkins street, to the same, $18,820; paving Haights Alley, to J. B. Sheets Co., $2,047; paving Herman street, to the Thomas Cronan Co., $6,605; paving Pamas street, to Ed O'Herron Co., $8,158; paving Charles street, to Booth & Flinn, $3,716.

Swissdale, Pa.—Street improvement contracts have been awarded as follows: To McGrady Bros., $48,000; E. J. Madigan Co., $8,000; The Prosser Contracting Co., $9,210.

Florence, S. C.—Constructing 40,000 sq. yds. macadam and bitulithic pavement, to the Atlantic Bitulithic Co., of Richmond, Va., about $50,000.

Memphis, Tenn.—The following concrete paving contracts have been awerded by the Speedway Land Co., 71 Madison avenue, Memphis: to D. S. Davies, $12,800; gravel roadway, to H. W. Brennan, $4,500.

Waco, Tex.—Constructing gravel roads, to Flannigan & Pritchett, of Waco, $100,000.

San Antonio, Tex.—Paving the main driveways of the capital, including about 12,500 sq. yds. of bitulithic, to the Texas Bitulithic Co., of Dallas, Tex.

Salt Lake City, Utah.—Constructing bitulithic paving on North Main street, to P. J. Moran, $38,825.

Salt Lake City, Utah.—Paving Fifth East street, to P. J. Moran, $95,849.

Portsmouth, Va.—Constructing curb and gutter and sidewalks on a number of streets, to Louis Lawson, of Norfolk, Va., $30,115.

Bellingham, Wash.—Paving Broadway, to the Independent Asphalt Co., $18,333.

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Colfax, Wash.—Constructing bitulithic paving on Main street and Mill street, to the Warren Construction Co., of Portland, Ore., $93,000.

Everett, Wash.—Improving road between Everett and Bothell, to the West Coast Construction Co., of Seattle, Wash., $21,802.

Madison, Wis.—Paving contracts have been awarded to the Andrews Asphalt Paving Co., of Hamilton, O., as follows: Langdon street, $19,475; Carroll avenue, $11,667.

CONTEMPLATED WORK.

Hillsborough, Cal.—The construction of eight miles of highway, probably oiled macadam, to cost $91,000, is contemplated. Haviland & Tibbetts, Alaska Commercial Bank building, San Francisco, Cal., engineers.

Oroville, Cal.—City Engineer Norris is preparing plans and specifications for the paving of a number of streets.

Santa Cruz, Cal.—The construction of a road between Santa Cruz and Watsonville, about 20 miles in length, is contemplated.

Wilmington, Del.—The construction of 188,000 sq. yds. of paving is contemplated. A. J. Taylor, city engineer.

Boise City, Ida.—Approximately 310,000 sq. yds. of asphalt, bitulithic or concrete pavement will be laid during 1912. Emily L. Savidge, city clerk.

Aledo, Ill.—The paving of the principal streets with Dolarway bitumen is contemplated.

Alton, Ill.—The construction of two miles of brick pavement is contemplated. J. P. Callahan, superintendent of public works.

Champaign, Ill.—The paving of Fifth street, about six blocks, is contemplated.

Decatur, Ill.—The city is contemplating the paving of North Jasper, East Williams and East Aves streets. Estimated cost, $48,275.

Mattoon, Ill.—Paving of a number of streets is contemplated. C. L. James, city engineer.

Peoria, Ill.—The paving of McClure avenue, for the distance of 1½ miles is contemplated.

Waukegan, Ill.—The paving of about five miles of street is contemplated.

Brazil, Ind.—Lewis township has voted to improve three roads as follows: With crushed rock road No. 1, 7,863 ft.; No. 2, 9,437 ft. and No. 3, 7,918 ft.

Terre Haute, Ind.—The commissioners of Parke and Vigo counties are contemplating the construction of a county road between the two counties, three miles in

length, and to be constructed of gravel. Nathan C. Wallace, county auditor of Vigo county.

Eldora, Ia.—The city is contemplating the paving of 22 blocks during the season of 1912.

Sheldon, Ia.—The paving of about 20 blocks of street early in the spring is contemplated.

Bridgeport, Mich.—The township has voted road improvement bonds for $20,000.

Houghton, Mich.—The construction of about four miles of macadam roadway is contemplated. R. Martin, engineer.

St. Joseph, Mich.—The Berrien county board of supervisors are contemplating road construction to cost $57,000.

Duluth, Minn.—City engineer has prepared plans and estimates for the paving of Railroad street with sand stone block.

Owaconna, Minn.—A $10,000 bond issue for the construction of pavements and sewers is voted.

Pawhuska, Okla.—Strike-axe township, in George county has voted road improvement bonds to the sum of $30,000.

Bay City, Ore.—The county commissioners are planning extensive road improvements.

Charleroi, Pa.—Washington county is contemplating the construction of about 35½ miles of road.

South Fork, Pa.—A $25,000 bond issue for the construction of pavement and roadways has been voted. O. P. Thomas, Johnstown, Pa., engineer.

Wilkes Barre, Pa.—District Engineer Arthur W. Long, of the state highway department, has been instructed to prepare plans for a road between Wilkes Barre and Scranton, Pa.

Loudon, Tenn.—A bond issue of $100,000 has been voted for road improvements.

Colfax, Wash.—Paving construction to cost about $60,000 is contemplated.

Wheeling, W. Va.—A $20,000 bond issue for the improvement of the road between Belaire and Bridgeport has been voted.

SEWERS.

BIDS REQUESTED.

St. Elmo, Ill.—P. E. Fletcher, city engineer, desires prices f. o. b. St. Elmo, on paving brick, grates for catch basins and sewer tile.

Ashtabula, O.—Nov. 28, 12 m. Constructing an outlet for street storm sewer. Includes 18-in. to 30-in. pipe sewer. A. J. Richardson, director of public service; A. B. Faulkner, clerk.

Pleasant Ridge, Hamilton County, O.—Dec. 16, 12 m. Constructing a sanitary sewer system and a sewage purification plant. Certified check, 5 per cent. H. B. Hayden, village clerk.

McKeesport, Pa.—Dec. 27, 7:30 p. m. Sewer construction as follows: 8-in. vitrified pipe sewer on Franklin avenue; 15-in. pipe sewer on Archer street; 8-in. sewer on Fawcett street. Bond, $3,000 on each bid. S. E. Soles, city controller.

Norristown, Pa.—Dec. 11. Constructing sewage disposal plant for town of 30,000 present population. F. Cameron Corson, borough engineer.

Neepawa, Man., Can.—Dec. 15, 8 p. m. Water works construction as follows: Contract A, laying water pipe and sewer; contract B, constructing pump house and filter room; contract C, constructing water power; contract D,, furnishing cast iron water pipe; contract E, furnishing gate valve, fire hydrant, etc.; contract F, furnishing and installing pumping machinery; contract H, constructing dam, intake and reservoir; contract M, constructing wood stave pipe; contract S, furnishing sewer pipe; contract W, laying conduit; contract X, constructing sewage disposal works. J. W. Bartley, secretary-treasurer. Chipman & Powers, Winnipeg and Toronto, engineers.

CONTRACTS AWARDED.

Osceola, Ark.—Constructing a sanitary sewer system and a disposal plant, to Roetzel & Chipman, of Osceola, Ark., $16,762.

Pine Bluff, Ark.—Paving West Barraque and West Pulles streets with creosoted wood block, to Shelby & Bateman, of Little Rock, Ark., $50,000.

Long Beach, Cal.—Constructing 26,000 ft. of sewer, to Watson & Spicer, $15,000.

Monrovia, Cal.—Constructing 26,000 ft. of sewer, to Watson & Spicer.

San Francisco, Cal.—Hauling and laying cast iron pipe for section B of the Ingleside outlet sewer, to the Coast Improvement Co., 68 Coast street, San Francisco, Cal.

Denver, Col.—Constructing sanitary sewer to the Westcott-Doan Investment Co., $27,785.

Summerville, Ga.—Constructing sewer system, to Guild & Co., of Chattanooga, Tenn., $11,000.

Payette, Idaho.—Constructing 16,700 ft. of 6-in. to 15-in. pipe sewers, to K. Sanset, of Corvallis, Ore., $18,908.

Chicago, Ill.—Constructing sewers on Wallace street, to Alphonso Scully, $19,200; constructing sewers on 37th street, to Alphonso Notordonato, $258.

Marsailles, Ill.—Constructing sewer extension, to Green & Son, of Ottawa, Ill., $51,158.

Princeton, Ill.—Constructing a sanitary sewer, involving 30,000 ft. of vitrified pipe construction, to the Hackworth Construction Co., of Appleton, Wis.

Fairfield, Ia.—Constructing sewer, to John Brogan, of Green Bay, Wis., $70,160.

Baltimore, Md.—Constructing the Jones Falls trunk sewer system, to Fisher-Carozza Co., of Baltimore, $704,000.

Boston, Mass.—The following sewer contracts have been awarded: Constructing catch basins and drains in Brighton and Dorchester, to Murphy & Dolan, $2,275; widening and deepening channel at the Calf Pasture pumping station, to J. P. O'Riorden, $10,920.

Buzzards' Bay, Mass.—Constructing 60-in. cast iron outfall sewer, to Patrick McGovern, Boston, Mass., $68,909.

Kansas City, Mo.—Constructing section of the Brush Creek sewer, to Michael Walsh, $47,859.

Kansas City, Mo.—Constructing sanitary and storm sewers as proposed by Paul McGeehan, superintendent of sewer division, to Williams & Sanle, $46,958.

Kansas City, Mo.—Constructing the east division of the Brush Creek sewer, to R. V. & G. T. Brown, Kansas City, Kans., $111,360.

St. Louis, Mo.—Constructing the second section of the Rock Creek district sewer, to George B. Prendergast Construction Co., $154,834.

Dunkirk, N. Y.—Constructing sewer in Central avenue, to John H. Crowe, $11,916.

Glen Falls, N. Y.—Constructing sewer system in South Glen Falls, to Sherman & Blackburn, $33,745.

Rochester, N. Y.—The following sewer contracts have been awarded. East Side trunk sewer, to William H. Sours, $42,502; the Thomas creek and Blossom road storm sewer, to H. M. Cowles, $36,762.

Yonkers, N. Y.—The following sewer contracts have been let: Constructing a sewer in Bronx road, to Joseph L. Cuozzo, 176 Oak street, $16,643.

Youngstown, O.—Constructing sewer in sub-district No. 3, to Lewis Agagasio, of Youngstown, O., $28,804.

Pittsburg, Pa.—Furnishing pumping engine at the Aspinwall pumping station, to the Dravo-Doyle Co., Lewis Bldg., Pittsburg, Pa., $37,990.

Brownsville, Tex.—Constructing Cameron county drainage district No. 1, including excavation, bridges, flumes, etc., to N. E. Rendall, of Brownsville, Tex., $161,542.

Dallas, Tex.—Constructing storm sewer on Pennsylvania avenue, to J. W. Smith & Son, $34,912.

Parkersburg, W. Va.—Constructing sewer on Laird avenue, to The Cantrel Construction Co.

CONTEMPLATED WORK.

Turlock, Cal.—Sewer extensions, to cost $12,500, are contemplated.

Ansonia, Conn.—City engineer is preparing plans for a sewer system, which includes 14,551 ft. of pipe.

Chicago, Ill.—The extension of a sewerage system, to Cicero & Austin, to cost about $214,000, is contemplated.

Murphysboro, Ill.—City Engineer Ralph Rollo is preparing plans and estimates for the East Side sewer system.

Fort Wayne, Ind.—Plans have been prepared for sewer improvements, to cost $513,000.

Kendallville, Ind.—A sewerage system, to cost $18,000, is contemplated.

Girard, Kans.—Burns & McDonnell, of the Scarritt Bldg., Kansas City, Mo., are preparing plans and estimates for a sewage disposal plant, to cost about $30,000. Fred Gerkes, city clerk.

Morgan City, La.—An $80,000 bond issue for the construction of a water works and sewerage system has been voted.

erage system, to cost $20,000, in South Salem, is contemplated. P. J. Kelly, sewer commissioner.

Sedalia, Mo.—S. G. Leaming, Sedalia, Mo., is preparing plans for a sewerage system and a disposal plant, to cost about $75,000.

St. Joseph, Mo.—The city is contemplating the construction of sewers in three sewer districts. David Lawlor, city engineer.

Union, Mo.—A $10,000 bond issue for sewer extension has been voted. The Fuller Construction Co., Chemical Bldg., St. Louis, Mo., engineers.

Las Vegas, Nev.—Lewis C. Kelsey, Selling Bldg., Portland, Ore., has been retained to prepare plans for sanitary sewerage system, to cost about $40,000.

Beverly, N. J.—The construction of a sewerage system, to cost about $35,000, is contemplated.

Caldwell, N. J.—The construction of a sewage disposal plant, to cost $90,000, is contemplated.

Solvay, N. Y.—The state department of health has ordered the village to construct a sewage disposal plant.

Whitestone, N. Y.—The construction of a sewer on 5th avenue, to cost about $75,000, is contemplated.

Yonkers, N. Y.—A. J. Hartmann, engineer of the Bronx Valley sewerage commission, has prepared plans and specifications for extending the outlet of the Bronx Valley sewer 150 ft. Estimated cost, $70,000.

Clayton, N. C.—A bond issue for the construction of a water works, sewerage system and electric light plant has been voted.

Barberton, O.—Sewer extensions, to cost about $40,000, are contemplated. Construction will begin in the spring of 1912.

Canton, O.—A site for the proposed sewage disposal plant has been purchased.

Cleveland, O.—City Engineer Hoffman has estimated the cost of an intercetping sewer system, at $2,750,000.

Dayton, O.—The city is contemplating the construction of storm sewers in Dry Hollow creek, to cost about $100,000.

Salem, O.—A $55,000 bond issue for the construction of a sewage disposal plant has been voted.

Forest Grove, Ore.—Standard & Richardson, 410 Henry Bldg., Portland, Ore., are preparing plans for a sewerage system, to cost about $70,000.

Ambler, Pa.—James H. Gillin has prepared plans and specifications for a sewerage system, to cost about $90,000.

Scranton, Pa.—A $54,000 bond issue for the construction of three sewers has been voted.

Towanda, Pa.—Surveys for the construction of a sewage disposal plant are being made by H. M. Pickersdill, representing F. H. Shaw, of Elmira, N. Y.

Clarksville, Tex.—A bond issue for the construction of a sewerage system has been voted.

Coppenish, Wash.—A $50,000 bond issue for sewer construction has been voted.

LaCrosse, Wis.—The construction of sewer extension, to cost about $110,000, is contemplated.

Revina, Sask., Can.—A $150,000 bond issue for sewer construction has been voted.

WATER WORKS.

BIDS REQUESTED.

Piedmont, Ala.—Dec. 9. Constructing water works extensions and an electric light plant. Estimated cost, $25,000. City clerk.

Wilmington, Del.—Dec. 11, 10:30 a. m. Furnishing the following equipment for the water works department: Two vertical triplex, single-acting power pumps, discharging 2,000,000 gallons and 4,000,000 gallons, respectively, with water turbines, discharging 80,000,000 gallons and 40,000,000 gallons under 19-ft. head at 78 r. m. p. Bond, 50 per cent. John A. Kienle, chief engineer board of water commissioners.

Washington, D. C.—An American consular officer states that the construction of an electric power plant of 10,000,000 units yearly, for use in connection with the clarification of the water supply of the city, is contemplated. The water supply of the city is 15,000,000 gallons daily. The clarification plant must have a capacity to remove amber-colored vegetable matter from 1,000,000 to 5,000,000 gallons of water daily. Address Bureau of Manufacturers, No. 7618.

Rushville, Ill.—Dec. 4, 2 p. m. Water works construction as follows: Furnishing 2,400 ft. of 6-in., 500 ft. of 10-in. cast iron pipe; 23,700 ft. of 10-in. 75-lb. wood stave pipe, 3,300 ft. 10-in. 125-lb. pressure wood stave pipe; 1,300 lbs. special castings; 16 ft. by 20 ft. brick building; one 250-gal. per minute, horizontal, multi-stage turbine pump, direct connected to a 30-h.p. 220-volt motor; one 450-gal. per minute turbine pump, driven by a 30-h.p. internal combustion engine; one well, 22 ft. deep and 12 ft. in diameter; a 6,000-volt transmission line of 29,000 ft. in length. City clerk. Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., engineers.

Mason City, Ia.—Dec. 12, 8 p. m. Furnishing a pump of 3,000,000 gal. capacity, including condensers. J. H. McEwen, city clerk.

Loreauville, La.—Dec. 15. Constructing water works system, including tank and tower. City clerk.

Cleveland, O.—Dec. 6, 12 m. Constructing the West Side lake tunnel for the water department. A. B. Lea, director of public service. Ira O. Hoffman, clerk.

Muskogee, Okla.—Dec. 5, 10 a. m. Furnishing a 6,000,000-gal., horizontal, high-duty crank and flywheel pumping engine to operate against a 320-ft. head. Certified check, 10 per cent. E. H. Fleming, commissioner of water and sewers; E. P. Clonts,

city engineer. Alexander Potter, New York City, consulting engineer.

Vancouver, Wash.—Dec. 27. Furnishing the following equipment: 24,000 ft. of 24-in. steel pipe; valves for Seymour creek; pipe line extension; excavation and backfilling of pipe trench for 36-in. steel-riveted pipe. William McQueen, city clerk. Herman & Burwell, engineers.

Elma, Wash.—Dec. 5, 3 p. m. Water works construction as noted in Bulletin of Nov. 11. Louis Kelsey, 404 Selling Bldg., Portland, Ore., engineers. C. M. Long, Elma, Wash., town clerk.

Neepawa, Man., Can.—Dec. 15, 8 p. m. Water works construction as follows: Contract A, laying water pipe and sewer; contract B, constructing pump house and filter room; contract C, constructing water tower; contract D, furnishing cast iron water pipe; contract E, furnishing gate valve, fire hydrant, etc.; contract F, furnishing and installing mechanical filters; contract G, furnishing and installing pumping machinery; contract H, constructing dam, intake and reservoir; contract M, constructing wood stave pipe; contract S, furnishing sewer pipe; contract W, laying conduit; contract X, constructing sewage disposal works. J. W. Bartley, secretary-treasurer. Chipman & Powers, Winnipeg and Toronto, engineers.

CONTRACTS AWARDED.

Dorris, Cal.—Installing complete water works system, to Moore Bros., of Dorris, Cal., $12,400.

Mounds, Ill.—Laying mains and hydrants, to O'Shea & Hogan, of Cairo, Ill., $14,580.

Fairfield, Ia.—Constructing filter plant, to the Jewell Water Improvement Co., of Chicago, Ill., $16,000.

Hiawatha, Kans.—Extending the water works system, to the Des Moines Bridge and Iron Works, of Des Moines, Ia.

Mound City, Kans.—The following water works contracts have been awarded: Filter plant, to Pittsburgh Filter Manufacturing Co., Pittsburgh, Pa.; pumps, to the Kansas City Engineering Co., Kansas City, Mo.; distribution system, to Thorgmartin, Gardner & Martin, of Fort Scott, Kans.

Lowell, Mass.—Constructing a pumping station at water supply station, to Patrick O'Hearn, $20,000.

Baraga, Mich.—Contracts for installing a municipal water works and electric light plant have been awarded to the following contractors: The Central Combination Co., of Oshkosh; the National Meter Co., of Chicago, and the Electric Equipment Co., of St. Paul, Minn. The total amount of the contract is $28,676.

Minneapolis, Minn.—Furnishing equipment for the filtration plant, to the Pittsburgh Filter Co., Farmers Bank Bldg., Pittsburgh, Pa.

Amory, Miss.—Constructing water works and sewers, to Sullivan, Long & Hagerty, of Bessemer, Ala., $67,250.

Shelby, Neb.—Constructing water works system, to the Des Moines Bridge and Iron Co., of Des Moines, Ia., $12,868.

Wilcox, Neb.—Constructing a complete water works system, to the Des Moines Bridge and Iron Works, of Des Moines, Ia., $12,226.

Niagara Falls, N. Y.—Constructing filter plant, to the Dravo-Doyle Co., Lewis Bldg., Pittsburgh, Pa.; constructing sedimentation tanks, to Farrar & Trefts, Perry street, Buffalo, N. Y.

Charlotte, N. C.—Constructing nine miles of 24-in. pipe line and a filtration plant, to Enslinger Bros., Niles, O., about $100,000.

Oklahoma City, Okla.—The Western Wells Co., of Kiowa, Kans., has been awarded the contract to furnish the city 5,000,000 gallons of water per day at two cents per 1,000 gallons. A deep well system is contemplated.

Jellico, Tenn.—Constructing about six miles of water mains, to Howard Neely, of Mt. Pleasant, Tenn.; furnishing hydrant valves and boxes, to the Columbian Iron Works, of Chattanooga, Tenn.

Seattle, Wash.—Laying water main on Fourth avenue, South, to Sparger Concrete Co., 559 Coleman Bldg., $13,922.

CONTEMPLATED WORK.

Piedmont, Ala.—A $25,000 bond issue for the enlargement of the water works and the construction of an electric light plant, has been voted.

Fullerton, Cal.—The installation of a municipal water plant is contemplated. Address Robert Meyers.

Orange, Cal.—A $50,000 bond issue for water works construction has been voted.

Watsonville, Cal.—The construction of a municipal water works plant, to cost about $100,000, is contemplated.

Fowler, Col.—A $25,000 bond issue for the installation of a water works system has been voted.

Meridian, Conn.—Additions to the water works system, to cost $10,000, are contemplate. J. B. Walsh, water commissioner.

Washington, D. C.—The construction of a $10,000 pumping plant on Minnesota avenue is contemplated.

Gainesville, Fla.—G. H. Cairns is preparing plans for a water works system, to cost $40,000.

Chipley, Ga.—The J. B. McCreary Co., Empire Bldg., Atlanta, Ga., has been retained to prepare plans and estimates for a water works system, to cost about $20,000.

Claxton, Ga.—A $30,000 bond issue for electric light and water works plant has been voted.

Rome, Ga.—Additions to the water warks system, to cost $75,000, is contemplated. W. M. Wilson, city engineer.

Pocatello, Idaho.—A $270,000 bond issue for the acquisition or construction of a municipal water works system has been voted.

Oregon, Ill.—A. M. Abbott desires catalogue and information on water works equipment.

Peoria Heights, Ill.—A $10,000 bond issue for the construction of a water works system, the total cost of which will be $25,000, has been voted.

Rushville, Ill.—A bond issue of $31,000 for the improvement of the water works system has been voted. W. A. Fuller, St. Louis, Mo., consulting engineer. Howard F. Dyson, city engineer.

Sheridan, Ind.—The Sheridan Water, Light and Heat Co. has been incorporated for $100,000 by J. L. Vickery, Perley Weaver, J. A. Branson, J. G. Antrim and Fred Beauchamp.

Audubon, Ia.—A $26,000 bond issue for additional water works construction has been voted.

Fowler, Kans.—The construction of a water works system, to cost $15,000, is contemplated. Worley & Black, consulting engineers, Kansas City, Mo.

Pittsburg, Kans.—The city is contemplating the extension of the water distribution system. L. E. Curfman, city engineer.

Lexington, Ky.—J. M. Caird, of Troy, N. Y., has prepared plans for the construction of a concrete coagulating basin, to cost about $50,000.

Madisonville, Ky.—The city is contemplating the construction of a water works system, to cost about $75,000.

Haynesville, La.—The city is contemplating the construction of a water works system, to cost about $10,000.

Morgan City, La.—An $80,000 bond issue

for the construction of a water works and a sewerage system has been voted.

Quincy, Mass.—The city is contemplating water works construction, to cost $10,000. E. C. Sargent, city engineer.

St. Paul, Minn.—The water board has been given authority to issue bonds in the sum of $75,000 for extending the service mains.

Lamar, Mo.—A $70,000 bond issue for the construction of a water works and electric light plant is voted.

St. Louis, Mo.—The extension of the water works distribution system, to cost about $150,000, is contemplated. Maxine Reber, president board of local improvements.

Webster Grove, Mo.—A $75,000 bond issue for the extension of the water works system has been voted.

Gordon, Neb.—A $34,000 bond issue for the completion of the water works system has been voted.

Yerington, Nev.—A $30,000 bond issue for the installation of a municipal water plant has been voted.

Pembroke, N. H.—Dudley & Sawyer, 936 Elm street, Manchester, N. H., are preparing plans for municipal water works plant.

Argyle, N. Y.—A $12,000 bond issue for the establishment of a water works system has been voted.

Waterford, N. Y.—The construction of a filter plant, to cost about $50,000, is contemplated.

Yonkers, N. Y.—The purchase of a 10,000,000-gal. pump and the construction of two filter beds, to increase the water supply, has been authorized. Estimated cost, $175,000. Campbell Scott, chairman water supply commission.

Devils Lake, N. D.—The city is contemplating the installation of a municipal water plant, to cost $32,000.

Delaware, O.—A $20,000 bond issue for the construction of a water works system has been voted.

Navarre, O.—A $25,000 bond issue for the water works construction has been voted.

Worthington, O.—A $20,000 bond issue for the construction of a water works system has been voted.

Bartlesville, Okla.—Bartlesville Water Co. has been incorporated for $150,000 by Swahty, of Chicago, Ill., and John George and John C. Hughes, of Bartlesville.

Clinton, Okla.—A $55,000 bond issue for the construction of a park system and the driving of a deep well has been sold, and the improvements will be started at once.

Clustee, Okla.—A $20,000 bond issue for water works construction has been voted.

Inola, Okla.—A $19,500 bond issue for water works construction has been voted.

Kingfisher, Okla.—The Benham Engineering Co., 812 The American National Bank Bldg., Oklahoma City, Okla., is preparing plans and specifications for a water works and electric light plant, for which $30,000 bonds have been voted.

Talihina, Okla.—A $25,000 bond issue for the construction of a water works system has been voted.

Tulsa, Okla.—Extensions of the water works system, to include a concrete and brick pumping station, wells, electrically-operated pump, cast iron pipe, hydrants, 100-k.w. generator, two motors, two centrifugal pumps, etc., to cost about $100,000, is contemplated. C. H. Sands, superintendent of water works.

Carleton, Ore.—Stannard & Richardson, 410 Henry Bldg., Portland, Ore., are preparing plans for a water works system, to cost about $40,000.

Haines, Ore.—A $20,000 bond issue for water works construction has been approved.

Hood River, Ore.—A $37,250 bond issue for the installation of a water works system has been voted.

Bethlehem, Pa.—A bond issue of $175,000 for the installation of a water works system has been voted. R. E. Newmeyer, engineer.

Philadelphia, Pa.—The South Easton Water Co. will construct a reservoir of 4,000,000-gal. capacity.

Warren, Pa.—The city is contemplating the purchase of a water works system, at a cost of about $490,000.

Corpus Christi, Tex.—The city is contemplating a water works system, to cost $250,000.

Killeen, Tex.—A $16,000 bond issue has been voted for the construction of a water works system.

Lott, Tex.—A $14,000 bond issue for water works construction has been voted.

Marlin, Tex.—The purchase of the water works plant, at a cost of $16,500, is contemplated.

Saint Jo, Tex.—A $10,000 bond issue for water works construction has been voted.

Waco, Tex.—The city is contemplating water works extensions, to cost $250,000. N. Renskiold, Dallas, Tex., engineer.

Bellingham, Wash.—The city is contemplating the extension of the water works system, to cost about $60,000. H. A. Whitney, city engineer.

Centralia, Wash.—C. G. Atterbury has prepared plans and estimates for water works extension, to cost between $90,000 and $100,000.

Prosser, Wash.—A $50,000 bond issue for the construction of a water works system has been voted.

Fox Lake, Wis.—The Oscar Claussen Engineering Co., of St. Paul, Minn., has prepared plans and estimates for a water works system, to cost about $20,000.

Madison, Wis.—A $20,000 bond issue for extension of the water works system has been ordered.

Two Rivers, Wis.—Extensions to the municipal light and water plant, to cost about $25,000, are contemplated.

Victoria, B. C., Can.—Plans are being prepared by Wynn Meredith, consulting engineer, for water works extension, consisting of dams, storage reservoirs, conduits and pressure pipe for delivering 16,000,000 gal. of water per day from Sooke Lake, about 30 miles west of the city.

BRIDGES.

BIDS REQUESTED.

Jacksonville, Fla.—Dec. 6, 10 a. m. Bridge construction as follows: Reinforced concrete bridge; constructing 6-ft. corrugated iron culvert on New York avenue. Gail L. Barnard, county engineer.

Newcastle, Ind.—Dec. 5, 10 a. m. Constructing and repairing several bridges. W. L. Risk, auditor.

Petersburg, Ind.—Dec. 5, 2 p. m. Constructing five bridges. John D. Gray, auditor.

Preston, Ia.—Jan. 4, 1.30 p. m. Constructing county bridges during the year of 1912. Estimated cost, $15,000. Theodore S. DeLay, surveyor of Union county.

New Orleans, La.—Dec. 28, 11 a. m. Erecting a Strauss trunion bascule bridge, under ordinance No. 7444. Certified check, $1,000. Charles R. Kennedy, controller.

Vicksburg, Miss.—Dec. 5, 12 m. Flooring two bridges. J. B. Laughlin, clerk.

Fulton, N. Y.—Dec. 18, 8 p. m. Constructing a concrete steel bridge across the Oswego river, at Broadway. Certified check, $10,500. J. A. Foster, president board of public works.

Columbus, O.—Dec. 15, 12 m. Bridge construction as follows: Constructing reinforced concrete box culvert, engineer's estimate No. 344; constructing new floor system for a bridge, under engineer's esti-

mate No. 345. Certified check, $200 on each bid. F. M. Sayre, county auditor.

Toledo, O.—Dec. 5, 12 m. Constructing a 2-leaf "Rall" bascule bridge across the Maumee river at Cherry street. J. R. Cowell, director of public service; S. G. Stockton, secretary.

Davenport, Wash.—Dec. 6. Constructing six steel bridges. J. W. Brislawn, county auditor.

Davenport, Wash.—Dec. 7. Furnishing corrugated metal culvert. J. W. Brislawn, county auditor.

CONTRACTS AWARDED.

LaSalle, Ill.—Constructing eight bridges, to the Joliet Bridge and Iron Co., of Joliet, Ill.

Jasper, Ind.—Constructing bridge across White river at Portersville, to the Vincennes Bridge Co., of Vincennes, Ind., $16,444.

Jackson, Miss.—The following bridge contracts have been awarded: Pearl river bridge and Oakley bridge, to the Vincennes Bridge Co., of Vincennes, Ind.; the Learned bridge, to the Southern Bridge Co.

Kansas City, Mo.—Constructing an ornamental reinforced concrete bridge at Wormall road, to J. H. Stone, Reliance Bldg., Kansas City, Mo., $10,600.

Selina, O.—Bridge contracts have been awarded to the following firms: Brookville Bridge Co., of Brookville, O.; Croghan Construction Co., of Fremont, O.; H. B. Hughes, of Selina, O.; Behnert & Flaylor, of Burkettsville, O.

Shawnee, Okla.—Constructing steel bridge at Epontuschi, to the Kansas City Steel Bridge Co., of Kansas City, Mo.

Rock Hill, S. C.—Constructing two steel bridges, to the Roanoke Bridge Co., of Roanoke, Va.

Stillwater, S. C.—Constructing a steel bridge, to Austin Bros., of Atlanta, Ga., $9,026.

Selmer, Tenn.—The following bridge contracts have been awarded: Constructing an 85-ft. bridge over Cypress creek, to the Beach Manufacturing Co., of Pharlow, Mich.; constructing a 45-ft. steel bridge, to the Joliet Bridge and Iron Co., of Joliet, Ill.

Angleton, Tex.—Constructing two steel bridges across the Brazos river, to the Midland Bridge Co., of Kansas City, Mo., $100,000. Francis F. Rite, Sweeney, Tex., engineer.

Gonzales, Tex.—Constructing two steel bridges, one across Peach creek and the other across Benton creek, to the Gonzales Bridge and Iron Co., of Gonzales, Tex.

Norton, Va.—Constructing 26 bridges, to the Roanoke Bridge Co., of Roanoke, Va., $23,350.

CONTEMPLATED WORK.

Lake City, Ark.—The construction of a bridge, to cost about $50,000, spanning the St. Francis river, is contemplated.

Sacramento, Cal.—Yolo county is contemplating the construction of about 50 concrete bridges.

Boise, Idaho.—The county commissioners will advertise for bids for the construction of an 80-ft. bridge over Indian creek.

Council Bluff, Ia.—The city engineer has been instructed to prepare plans and estimates for a concrete bridge on North Main street.

Des Moines, Ia.—Plans for a bridge across the Des Moines river, at North street, to cost about $100,000, has been ordered.

Orono, Maine.—A steel bridge, to cost about $30,000, will be erected by the town of Orono and the Bangor Railway and Electric Co.

Hackensack, N. J.—The construction of a bridge across the Hackensack river, to cost $150,000, is contemplated. R. Earle, Jr., county engineer.

Fulton, N. Y.—The construction of a concrete bridge at Broadway, to cost $80,000, is contemplated.

Wilmington, N. C.—The construction of a steel bridge over the North East river, to cost about $35,000, is contemplated. Commissioners of New Hanover and Pender counties.

Muskogee, Okla.—A $10,000 bond issue, voted by the town of Haskell and the township of Gatesville for the construction of a bridge across the Arkansas river, has been approved. Charles Bagg, attorney.

Phoenixville, Pa.—The county commissioners of Chester and Montgomery counties have decided to construct a bridge across the Schuylkill river.

Kamloops, B. C., Can.—Plans have been prepared for the construction of a new highway bridge across the South Thompson river.

STREET LIGHTING.

BIDS REQUESTED.

Chicago, Ill.—The Dearborn Street Improvement Association will install 140 ornamental lights along Dearborn street. About $50,000 is available. John C. Roth, president; John C. McCord, Adams Express Bldg., Chicago, Ill., secretary.

Corydon, Ia.—Dec. 5. Constructing an electric light plant, including boilers, engines, generators and all electrical equipment. J. J. C. Bower, town clerk. Iowa Engineering Co., Clinton, Ia., engineers.

Enfield, N. C.—Dec. 6, 8 p. m. Constructing an electric light plant. W. T. Clement, mayor. C. E. Fairbanks, 417 American National Bank Bldg., Richmond, Va., engineer.

Santo Domingo—Dec. 15. The American vice-consul general at Santo Domingo has forwarded specifications, calling for bids for the installation of a complete electric light plant. Address Bureau of Manufacturers, No. 7596.

CONTRACTS AWARDED.

Marshallville, Ga.—Constructing water works and electric light plant, to J. P. Walker.

Muskegon, Mich.—A ten-year lighting contract has been granted to the Grand Rapids-Muskegon Power Co. at $57.50 for arc lights and $16 for 60-c.p. incandescent.

CONTEMPLATED WORK.

Piedmont, Ala.—A $25,000 bond issue for the enlargement of the water works and the construction of an electric light plant has been voted.

Claxton, Ga.—A $30,000 bond issue for electric light and water works plant has been voted.

Beardstown, Ill.—The construction of a municipal light plant is contemplated.

Galena, Ill.—The Interstate Light and Power Co. is contemplating the installation of an ornamental lighting system.

Oregon, Ill.—A. M. Abbott wishes catalogue and information regarding street lighting.

Streator, Ill.—The city is contemplating the installation of an ornamental lighting system.

Angola, Ind.—An ornamental street lighting system is contemplated.

Bouton, Ia.—Constructing electric light and power station, to the Jones Electric Co., of Perry, Ia.

Glidden, Ia.—A $10,000 bond issue for

the construction of an electric light plant has been voted.

Jewell, Ia.—The installation of an ornamental street lighting system is contemplated.

Stony City, Ia.—The city is contemplating the installation of an ornamental lighting system. Address secretary Commercial Club.

Houghton, Mich.—The city is contemplating changing the lighting system to flaming arcs.

Mt. Clemens, Mich.—The lighting of the streets with gas is contemplated.

King City, Mo.—The city has voted to install a municipal light plant.

Kearney, Neb.—The city is contemplating the construction of a municipal lighting plant and an ornamental lighting system.

Chipewa, N. Y.—The Business Men's Association is experimenting with a better type of street light.

Little Falls, N. Y.—The city is contemplating the construction of a municipal light plant. Mathew A. Leahy, city clerk.

Oswego, N. Y.—The city is contemplating the installation of an ornamental lighting system in the business district.

Rochester, N. Y.—The installation of an ornamental lighting system is contemplated by the residents of South Fitzhugh street. Joseph E. Putman, city electrician.

Cleveland, O.—A $2,000,000 bond issue for the construction of a municipal electric light plant has been voted.

Kingfisher, Okla.—The Benham Engineering Co., 812 American National Bank Bldg., Oklahoma City, Okla., is preparing plans and specifications for a water works and electric light plant, for which $30,000 bonds have been voted.

Muskogee, Okla.—The Tahlequah Gas and Power Co. has been incorporated for $25,000, by D. M. Luteman, H. P. Woods and David Parr.

Ponca City, Okla.—A $30,000 bond issue for a municipal electric light and power plant has been voted.

Eugene, Ore.—A $25,000 bond issue has been sold for the purpose of installing an ornamental lighting system.

Del Rio, Tex.—The City Ice and Electric Co. has been incorporated with a capital stock of $40,000, by C. D. Foulke, W. H. Wolff and J. A. Farnam.

Aberdeen, Wash.—The installation of several new acrs and tungsten lights is contemplated.

Colfax, Wash.—The installation of a number of street lights is contemplated.

Ellensburg, Wash.—The installation of an ornamental lighting system on six streets is contemplated.

Sultan, Wash.—The city clerk has been directed to advertise for bids on ornamental lighting system.

Sunnyside, Wash.—The installation of 7½-ampere magnetite lamp for street lighting purposes is contemplated.

Victoria, Wash.—The city is contemplating the installation of a cluster of lighting system.

Manitowoc, Wis.—A $40,000 bond issue for light and water works improvement has been voted.

Two Rivers, Wis.—Extensions to the municipal light and water plant, to cost about $25,000, are contemplated.

FIRE APPARATUS.

BIDS REQUESTED.

Pasadena, Cal.—Dec. 5, 10:30 a. m. Furnishing one motor propelled automobile fire engine and hose wagon, and one motor propelled automobile chemical engine and hose wagon. Herman Dyer, city clerk.

Moose Jaw, Sask., Can.—Dec. 4, 8 p. m. Furnishing one fire department pumping engine of 800 to 850 gallon per minute capacity. W. S. Heal, city clerk.

CONTEMPLATED WORK.

New Decatur, Ala.—The city is contemplating the purchose of an automobile fire engine, to cost about $5,000.

Orange, Cal.—A $5,000 bond issue for the purchase of fire equipment has been voted.

New London, Conn.—The purchase of a motor fire engine to cost about $6,500 has been recommended.

West Palm Beach, Fla.—A $6,000 bond issue for the purchase of fire equipment has been voted.

Sumter, Ga.—The city has voted to purchase an auto fire engine for the local fire department.

Oregon, Ill.—A. M. Abbott desires information on auto propelled fire apparatus.

Shreveport, La.—A $50,000 bond issue for the erection of fire station and the purchase of equipments has been voted.

Brockton, Mass.—The sum of $5,500 has been provided for the purchase of an automobile chemical engine.

Fitchburg, Mass.—The city is contemplating the purchase of motor fire apparatus.

Somerville, Mass.—The city is contemplating the addition of an automobile fire engine, which will be purchased early in 1912.

Taunton, Mass.—A loan of $5,500 for the purchase of an automobile fire truck has been voted.

Massillon, O.—An ordinance authorizing a bond issue of $8,000 to transform two of the horse-drawn combination chemical engines into automobile apparatus has been voted.

Newport, O.—The purchase of an automoblie chemical engine for the fire department is contemplated.

Zanesville, O.—The city is contemplating the purchase of a motor fire engine.

Braddock, Pa.—The borough is contemplating the purchase of two automobile fire trucks; one to be a combination hook and ladder and the other a hose truck.

West Chester, Pa.—A $46,000 bond issue for sewer construction has been sold.

Terrell, Tex.—The city commission is contemplating the purchase of an automobile fire engine to cost about $7,500.

Wheeling, W. Va.—The city is contemplating the purchase of an automobile fire engine.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

BIDS REQUESTED.

Indianapolis, Ind.—Dec. 6. Collecting and disposing of garbage from May 26, 1912. Bids for one and six year periods asked. C. A. Schrader, president board of public works.

Boston, Mass.—Dec. 5, 12 m. Disposing of refuse for a term of 10 years from July 1, 1912. Certified check, $10,000. Bond, $100,000. Louis K. Rourke, commissioner of public works.

CONTEMPLATED WORK.

Atlanta, Ga.—The city is contemplating additional crematory service other than is provided by a $50,000 bond issue recently voted.

Newport, Ky.—A $20,000 bond issue for the construction of a garbage disposal plant has been voted.

Monongahela, Pa.—A $10,000 bond issue for the construction of a garbage plant has been sold.

DIRECT SALES

AND MANY INQUIRIES

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